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16. ABSTRACT

This is a student manual to be used in the air pollution training course 444 entitled "Air Pollution Field Enforcement". It is essentially a textbook for the 3½ day course for governmental air pollution control agency personnel responsible for enforcement of air pollution regulations. Topics covered include the role of the field enforcement officer; the enforcement process; surveillance techniques; handling odor complaints; inspection techniques; emission control equipment; legal procedures; and enforcement programs.

The Student Manual is to be used in conjunction with the Instructor's Guide (EPA 450/2-80-077) and Student Workbook (EPA 450/2-80-076).

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Air

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Air Pollution Field Enforcement

Student Manual

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Notice

This is not an official policy and standards document. The opinions, findings, and conclusions are those of the authors and not necessarily those of the Environmental Protection Agency. Every attempt has been made to represent the present state of the art as well as subject areas still under evaluation. Any mention of products or organizations does not constitute endorsement by the United States Environmental Protection Agency.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

AIR POLLUTION TRAINING INSTITUTE
MANPOWER AND TECHNICAL INFORMATION BRANCH
CONTROL PROGRAMS DEVELOPMENT DIVISION
OFFICE OF AIR QUALITY PLANNING AND STANDARDS

The Air Pollution Training Institute (1) conducts training for personnel working on the development and improvement of state, and local governmental, and EPA air pollution control programs, as well as for personnel in industry and academic institutions; (2) provides consultation and other training assistance to governmental agencies, educational institutions, industrial organizations, and others engaged in air pollution training activities; and (3) promotes the development and improvement of air pollution training programs in educational institutions and state, regional, and local governmental air pollution control agencies. Much of the program is now conducted by an on-site contractor, Northrop Services, Inc.

One of the principal mechanisms utilized to meet the Institute's goals is the intensive short term technical training course. A full-time professional staff is responsible for the design, development, and presentation of these courses. In addition the services of scientists, engineers, and specialists from other EPA programs, governmental agencies, industries, and universities are used to augment and reinforce the Institute staff in the development and presentation of technical material.

Individual course objectives and desired learning outcomes are delineated to meet specific program needs through training. Subject matter areas covered include air pollution source studies, atmospheric dispersion, and air quality management. These courses are presented in the Institute's resident classrooms and laboratories and at various field locations.

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February 6, 1979

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FOREWORD

The Air Pollution Field Enforcement Course, No. 444, has been part of the curriculum of the Air Pollution Training Institute since its beginning in the late 1960s. It has been given more than 50 times with the agenda altered to meet the changing needs of enforcement created by frequent enactment of new air pollution legislation at the federal, state, and local government levels.

In 1977, the United States Environmental Protection Agency commissioned Charles W. Gruber, P.E., Cincinnati, Ohio and Michael V. McIntire, J.D., Santa Monica, California to survey ten diverse control agencies to determine the continuing need for training in field enforcement. The survey concluded:

> "The need is for a primary course for inexperienced personnel, as well as a 'back to basics' refresher course for experienced field enforcement officers."

In mid 1978, the Air Pollution Training Institute commissioned Charles Gruber to carry out the survey recommendations by rewriting Course 444 objectives and subject materials. Pamela M. Giblin, attorney, Austin, Texas, was selected to contribute the legal aspects.

Both authors drew upon their personal experiences of many years of involvement in air pollution control administration and enforcement. For more than eight years, both lectured in previous presentations of Course 444.

The revised objectives and agenda, approved by the Air Pollution Training Institute at the beginning of the work, have been constructed to teach the broad principles which guide the Field Enforcement Officer in the conduct of his duties.

The course covers three and one-half days, divided into:

First Day—The Field Enforcement Officer, His Job, How He Prepares Himself, and How He Does It.
Second Day—The Legal Aspects of Enforcement.
Third Day—The Technical Aspects and Workshops.
Fourth Day—Continuation of Third Day Subjects and Summation.

Three separate books comprise the course resource material:

1. The Student Manual, written especially to parallel the course sequence.
2. The Student Workbook, containing six exercises.
3. The Instructional Resource Material Book for the course faculty.

The work was performed under the United States Environmental Protection Agency, Contract No. 68-02-3014.

February 6, 1979

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GOAL OBJECTIVES

Overall Goal

To maximize the effectiveness of the Field Enforcement Officer (FEO) in the performance of those tasks which seek to bring sources into compliance and to so maintain them.

The overall goal is broken down into five areas of expertise:

1. Personal development,
2. Acquisition of skills in doing day to day tasks,
3. Recognition of violations and gathering proof thereof,
4. Ability to write effective reports and orders, and
5. Ability to effectively present evidence before administrative and judicial tribunals and to defend such evidence under cross-examination.

1. Personal Development

To evolve a recognition of those personal qualities which characterize an effective FEO and how these qualities are developed. To stimulate desire and enthusiasm for continuing self-training and for personal development.

2. Acquisition of Skills

To teach the many and varied skills needed by the FEO in performing his day to day field tasks of striving to bring sources into compliance and to so maintain them. The agency programs for accomplishing and maintaining compliance are:

- The external surveillance of sources,
- Responding to citizen complaint,
- Conducting internal source inspections,
- Performing field inspections for permits to construct and permits to operate as may be assigned to the FEO, and
- Reacting to emergency episodes.

3. Recognition of Violations and Gathering Proof

From the daily field activity, certain violating situations will be observed. The ability to recognize the elements of the violation and to gather proof thereof will be taught. An understanding of the constitutional and legal (Clean Air Act and Amendments and state and local laws and regulations) basis for action will be generated. The interaction between local, state, and federal agencies in enforcement will be discussed.

4. Writing Effective Reports and Abatement Orders

Writing of reports to serve as the official record of the action taken by the FEO will be taught. The form and content of effective orders will be demonstrated.

5. Presentation of Evidence

Skill will be developed in presenting evidence in a persuasive manner through lecture, practice, and mock situations. Monitoring and enforcement of orders as an essential part of effective action will be taught.

Terminal Objectives

The student who successfully completes this course shall be able to:

1. Identify the fundamental relationships which structure the air pollution control programs at various levels of government in the U.S.
2. Demonstrate an awareness of the personal qualities needed by an FEO to successfully carry out his mission.
3. Define the skills needed by the FEO as he performs his day-to-day tasks.
4. Differentiate between good and bad job performance in field work.
5. Recognize from observation, conditions of violation as well as compliance at sources under surveillance or inspection.
6. Identify the factual information and related data necessary to prove violations.
7. Identify the principles of effective reporting for a record of the FEO activity and actions.
8. State the principles of off-site surveillance.
9. Identify the various alternative measures available for bringing sources into compliance.
10. Construct evidential proof of conditions of noncompliance.
11. Identify the steps necessary to conduct on-site investigations of sources in response to observed violations, scheduled inspections, delayed compliance orders, court orders, and citizen complaints.
12. Differentiate between persuasive and ineffective testimony presented during mock direct testimony and cross-examination of witnesses.
13. Identify the Constitutional and legal basis for all actions by the FEO in the process of bringing sources into compliance.
14. Identify the sequence of actions to be taken by the U.S. EPA in FCAA Section 113 enforcement actions.
15. Differentiate between role of federal, state and local control agencies in the overall enforcement program.
16. Differentiate between common law and statutory law.
17. Differentiate between administrative and litigation procedures as strategies for bringing sources into compliance.
18. Identify the major categories of control hardware from their external appearance; list the major parameters of performance; and identify a major cause of failure to perform effectively at any point in time as compared to the permit conditions.
19. Identify the principles of combustion and list the important inspection points of a coal or oil fired power plant.

The terminal objectives stated here will be restated in the beginning of each chapter of this manual. They will be expanded or revised, as necessary, to fully state what you are expected to learn as you progress through the course curriculum.

Definition of "Successfully completes the course". You will be considered as successfully completing the course if you are present 95 percent of class time, turn in all your assignments, and receive an overall grade of no less than 70 percent on all tests and assignments. Active participation in class discussions and exercises may be considered where test grades are marginal.

FIELD ENFORCEMENT OFFICER

JOB DESCRIPTION

This section is included to acquaint you with the variety of tasks that may be required of the Field Enforcement Officer (FEO). Not all enforcement units are structured alike; however, the tasks included here are those generally assigned to the FEO. They are developed from the author's experience and by reference to the EPA Technical Report, "Task Analysis of State and Local Air Pollution Control Agencies and Development of Staffing Guidelines," Volume C, Field Enforcement, November, 1972.

General Nature of the Work

The FEO functions in the field, having direct responsibility for securing compliance with the rules and regulations pertaining to the operation, maintenance, and inspection of air pollution source facilities. Initial construction permit and scheduled re-inspections of large technically complex source facilities such as refineries, steel mills, petro chemical plants and the like, are often assigned to specialized FEOs sometimes called engineering inspectors, but responsibility for ongoing operational compliance and complaint investigation is nearly always the responsibility of the general district FEO.

Tasks to be Performed

A. Field Surveillance of an Assigned Area

Traditionally, the FEO has been assigned an area or "district" for the purpose of detecting: violations of the visible emission regulation, open burning restrictions, permit to construct and operate requirements; excessive damage to vegetation and large particle fallout; fugitive dust sources from construction or demolition projects; or other sensory manifestations of some condition of non compliance with the rules and regulations. Upon detection, he conducts the necessary investigation and records the facts to prove the violation to the extent that will allow his agency to take the required enforcement action to bring the source into compliance. Most observed violations require subsequent onsite inspection and investigation.

B. Complaint Investigation

Complaint investigation is universally assigned to the FEO. The objective is to satisfy the complainant's request for the abatement of an alleged nuisance problem. The FEO's role is to collect enough information to determine if the complaint is valid and can be corrected through the control functions of the agency. Most valid nuisance complaint investigations require field surveillance within the area of the complaint location and often require subsequent onsite inspection and investigation.

C. Onsite Inspection and Investigation

This task is defined as entering a source facility premises for the purpose of:

(a) inspecting for compliance with an issued document, such as a permit to construct, to operate, or to register a new or altered source;
(b) conducting a scheduled re-inspection as an annual inspection;
(c) determining compliance with a prescribed order of abatement;
(d) investigating the cause and responsibility of an observed violation and to serve the necessary notices, orders as required;
(e) completing the complaint investigation process;
(f) do such other things as are necessary to carry out the enforcement responsibility of the FEO.

Note: Often the large, highly complex technical sources, such as refineries, steel mills, petro chemical plants, or utility stations are assigned to specialty field enforcement officers, sometimes called engineering inspectors. These specially trained FEOs may be assigned either to the enforcement or engineering division of the agency.

D. Preparation of Reports and Selection of the Compliance Action

A vital task is the documentation of the field activity of the FEO. In the case of inspections for compliance, approval or noncompliance forms are completed. For violation or complaint investigation, concise and complete reports are prepared. In many agencies (but not all), the FEO takes or recommends the appropriate compliance action upon completion of the record.

E. Serving as a Witness in Court or at a Hearing

Frequently the FEO must appear in court or before a hearing body to represent the agency as an expert witness. They are required to make their presentation clearly and to respond calmly to cross-examination or criticism from opponents of the agency's position.

LISTING OF ACRONYMS

AAQ	**Ambient air quality**
AAQS	**Ambient air quality standards**
ACN	**Appropriate control needed**—reduction factor needed to attain NAAQS
ALAPCA	**Area or local air pollution control agency**, including local, county, regional agencies and the district offices of state agencies.
AP	**Air pollution**
APC	**Air pollution control**
APCA	**Air pollution control agency** or **air pollution control association**
APCD	**Air pollution control district**
AQCR	**Air quality control region**—geographic area which, due to weather or air pollution, needs a common strategy to control air quality.
AQMP	**Air quality maintenance plan**—the part of the SIP designed to ensure than an area does not develop new pollution problems from uncontrolled growth once it has cleared up its present air problems.
BACT	**Best available control technology**—an emission limitation based on the maximum degree of reduction of each pollutant, on a case by case basis, which is achievable through application of production processes and available methods, systems and techniques, for the control of each such pollutant [shortened from FCAA Sec. 169 (3).]
CAA	**Clean Air Act of the U.S.** as amended in August, 1977.
CAAA	**Clean Air Act Amendments** of 1977—Public Law 95-95, amending the 1970 Clean Air Act, specifies local air pollution control plans.
CO	**Carbon monoxide**—colorless, odorless gas resulting from the incomplete combustion of hydrocarbon fuels, primarily produced by gasoline engines.
EPA	**U.S. Environmental Protection Agency**
FCAA	**Federal Clean Air Act**
FEO	**Field enforcement officer**—includes air pollution inspector, field inspector, or field engineering inspector
HC	**Hydrocarbon**—an organic compound (such as acetylene or benzene) containing only carbon and hydrogen and often occurring in petroleum, natural gas, coal and bitumens.
I/M	**Inspection/maintenance**—a program of vehicle exhaust testing and required maintenance to certify that the vehicle's emission control devices are operating properly.
LAER	**Lowest achievable emissions rate**—the lowest possible emissions rate for stationary source pollutants using control devices.
NAAQS	**National ambient air quality standards**—levels of pollutant concentrations above which human health or welfare is affected, established by EPA.

NESHAPS	**National emission standard for hazardous air pollutants** — special emission limits for hazardous pollutants such as beryllium, mercury, vinyl chloride, asbestos, that are not regulated by the NAAQS.
NMHC	**Non-methane hydrocarbons** — all hydrocarbons except methane.
NO_x	**Nitrogen oxides** — gases composed of nitrogen and oxygen atoms, such as NO and NO_2, produced by the burning of fuel at high temperatures and pressures.
NSPS	**New source performance standards** — standards of emissions rates for specified new and modified stationary sources as published by the U.S. EPA.
O_3	**Ozone** — pungent toxic colorless gas which is the major component of photochemical oxidants.
Ox	**Oxidant** — photochemical oxidants, mainly ozone, formed by the action of sunlight on hydrocarbons and nitrogen oxides.
PSI	**Pollutant standard index** — a procedure, devised by the U.S. EPA, to be used by state and local air pollution control agencies to report to the public the index of air quality of their respective jurisdictions on a daily basis.
PSD	**Prevention of significant deterioration** — policy aimed at preserving clean air areas.
RACT	**Reasonably available control technology** — the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.
RFP	**Reasonable further progress** — annual incremental decreases in emissions that will enable the region to reach NAAQS which must be demonstrated annually.
SIP	**State implementation plan** — plan describing the ways in which various parts of the state intend to reduce air pollution.
SO_2	**Sulfur dioxide** — gaseous pollutant produced mainly by the burning of sulfur-containing fuel, and also smelting of nonferrous minerals and some chemical processes.
STAPPA	**State and Territorial Air Pollution Program Administrators**
TSP	**Total suspended particulates** — small particles of solid or liquid suspended in air, such as fog, dusts, mists, fumes, or smoke.
U.S. EPA	**United States Environmental Protection Agency** — federal agency.
TPY	**Tons per year** — units used to quantify the total amount of a pollutant emitted over the course of a year.

Chapter 1

Overview of Air Pollution Control

OVERVIEW OF AIR QUALITY CONTROL

Goal

To present the broad objectives and means of attainment of the air pollution control effort in the USA as described in SI Course 422. A conceptual ambient air quality model is developed.

Objectives

At the end of this lesson the student should be able to:

1. Recite the ultimate goal of the air pollution control agency and how progress toward the goal is measured.
2. Define ambient air quality.
3. Explain the fundamental relationships which create ambient air quality.
4. Name the criteria pollutants.
5. Differentiate between primary and secondary National Ambient Air Quality Standards and between primary and secondary pollutants.
6. Explain background pollution levels.
7. List two hazardous pollutants covered by NESHAPS.
8. Identify three meteorological factors important in air pollution control.
9. Identify the basic concept of air quality control in the U.S.
10. Define atmospheric reaction products.
11. State the source of regulations enforced by the state and local FEOs.

Selected Reading

Reference 1*, The Clean Air Act: Sections 101, 102, 108, 109, 112.
Reference 8, Course SI 422: Air Quality Management, Air Pollutants and their Sources, Meteorology in Air Pollution Control.
Reference 4, APTD-1100, Chapter 1, Sections I, II, III, IV, and VI, a and b only

*References are found in the back of this manual.

OVERVIEW OF AIR POLLUTION CONTROL

Introduction

An understanding of the principles of air quality management will give a better comprehension of the role of the field enforcement officer. Air Pollution Control Orientation Course 422, a self-instructional program, is highly recommended as preparation for study in the field of air pollution enforcement. "Overview" highlights the fundamentals of air quality management for the benefit of the entering students who may not have completed Course 422.

Air Quality Management Development

Overall Program Objective

The basic objective of the air pollution control programs is to attain and maintain a level of outdoor air quality which will: (a) protect against adverse effects on public health and welfare; and (b) prevent significant deterioration of regions where the air is considered pristine, as in national parks and wilderness areas.

Health and Welfare

Health is considered to be a state of complete physical, mental and social wellbeing and not merely the absence of disease. The Clean Air Act, Sec. 302 (h), states that all language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wild life, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and wellbeing.

Ambient Air Quality Defined

Monitoring progress toward the ultimate goal is accomplished by measuring the AAQ. Because the ambient air system is constantly fluid, ambient air quality is also highly variable. Ambient air quality is, therefore, defined as a pattern of the occurrences of levels of air contaminants in the outdoor air.

An Ambient Air Quality Model

A conceptual ambient air quality model may be developed to present the major factors contributing to the air quality of a region. The model separates emitters from receptors and demonstrates that air quality results from the summation of all the emissions from sources, atmospheric reaction products, background inflow, and re-entrainment of surface contamination, all transported, diffused, or accumulated, depending upon meteorological parameters.

The model is written as

$$AAQ = \frac{E + A + B + C}{F}$$

where

AAQ is the ambient air quality in $\frac{g}{m3}$

E is the sum of emissions from both stationary and moving sources, plus the fugitive emissions from storage piles, material handling, construction and demolition, building openings, etc. These are identified as the point and area sources within the air quality control region. The units are $\frac{g}{\theta}$ (*Note:* θ is any selected time period consistent for all terms of the model.)

A is the atmospheric reaction products resulting from chemical interaction between selected E contaminants, needing solar radiation (sunlight) to catalyze the reaction. The units are $\frac{g}{\theta}$.

B is the background pollutants flowing into the AQR from outside its boundaries. The units are $\frac{g}{\theta}$.

C is the contaminants which were once deposited on the surfaces within the AQR and are re-entrained into the atmosphere in varying degrees, depending upon people activity and the wetness of the surfaces or the snow cover. The units are $\frac{g}{\theta}$.

F is the volume flow of atmospheric air in and out of the AQR. Since the greater the flow in the greater the outflow, F is placed in the denominator as a diminishing factor. The units are $\frac{m^3}{\theta}$.

The model is applied to each pollutant separately. This is valid because AAQ is on a single contaminant base, each one relating to an individualistic effect. In so doing, one or more of the terms may reduce to zero, such as:

for SO_x

$$AAQ = \frac{E + O + B + O}{F}$$

as no SO_x is formed by atmospheric reactions (A) or re-entrained (C).

for TSP

$$AAQ = \frac{E + A + B + C}{F}$$

atmospheric reactions produce both gases and aerosols.

for O_x

$$AAQ = \frac{O + A + B + O}{F}$$

as no O_x is emitted from sources (E) or re-entrained (C).

Air Quality Index

A number and/or a descriptive term to describe the level of air quality for a place at any period of time, as a day. The number is referred to as an index and is calculated for the various pollutants using a method prescribed by the U.S. EPA to determine the Pollutant Standard Index, or a method devised by a particular state.

Pollutant Standard Index

A pollution standards index (PSI) developed by the U.S. Environmental Protection Agency will eventually be used by all cities larger than 200,000. Some cities have been using PSI since 1976. PSI divides the amount of pollution by the EPA standard for each of the five major air pollutants — nitrogen dioxide, sulfur dioxide, carbon monoxide, photochemical oxidants and particulate matter — and comes up with a number between 0 and 500.

Those numbers and their meanings are:

0-50 — good
51-100 — moderate
101-200 — unhealthful
201-300 — very unhealthful
301-500 — hazardous.

Accompanying each number range are descriptions of the general health effects of their air quality levels and precautions to take.

Meteorological parameters are involved in several terms of the model.

- Horizontal wind flow affects F.
- Stability or turbulence influences vertical air mass movement and therefore F.
- Solar radiation influences A as the catalyst.
- Rainfall, wetting surfaces, snow cover, and humidity can influence C and B.

The significance of background, (B) is considerable in determining the required reduction of E to meet the AAQS. When B exceeds the AAQS, no amount of reduction in E will gain attainment.

National Ambient Air Quality Standards

National Ambient Air Quality Standards have been promulgated by the Administrator of EPA, as required by the CAA, to describe an acceptable air quality. Six pollutants called "criteria pollutants" were originally named: CO, SO_2, NO_2, HC non-methane, O_x, and total suspended particulates (TSP). Recently lead has been added as a criteria pollutant. Photochemical oxidant (O_x) standard has become specifically an ozone (O_3) standard.

Primary and Secondary Standards

To further define the AAQ goals, NAAQS are divided into primary, health protecting, and secondary, welfare protecting, standards. Secondary standards are lower values of contaminant concentration (better quality) than the primary (health) values as health must always be protected after which a better quality for welfare can be sought.

Primary and Secondary Pollutants

The primary pollutants are those which do not change in the atmosphere or contribute to the atmospheric reactions. In the AAQ Model, these are the E pollutants which include: CO, SO_x, TSP, NO, and HC. Secondary pollutants are the reaction products included in the A term of the Model, primarily O_3 and NO_2.

Hazardous Pollutants

The CAA, Sec. 112,(a)(1), defines hazardous pollutants as those "which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." National Emission Standards for Hazardous Air Pollutants, NESHAPS, have been established for such pollutants as asbestos, beryllium, and mercury.

Other Pollutants

The state and local jurisdictions are vitally concerned with many contaminants not included in the national program. These "other" contaminants cause a variety of effects in local areas, such as vegetation and materials damage, injury to livestock, and discomfort to people because of foul odors. Regulations dealing with "other" pollutants are enacted and enforced by the state and local agencies.

Air Quality Control in the U.S.

Air quality control in the U.S. is a two level program, with the effort of the states and their political subdivisions dictated by their own legislative actions to meet their particular needs, and the federal program based on federal laws and regulations created by the Clean Air Act. Since 1970, the federal program has strongly influenced state and local programs through the promulgation of national requirements imposed on states and local governments.

Enforcement Responsibilities

The major direction of the enforcement program which determines the role of the state and local field enforcement officer comes from the control strategies embodied in the state implementation plans. The federal officers find their enforcement role spelled out in the CAA and resulting federal regulations. Both levels of enforcement action target the same major sources leading to a cooperative, a duplicate, or a unilateral action, often confusing to the regulated sources and the public.

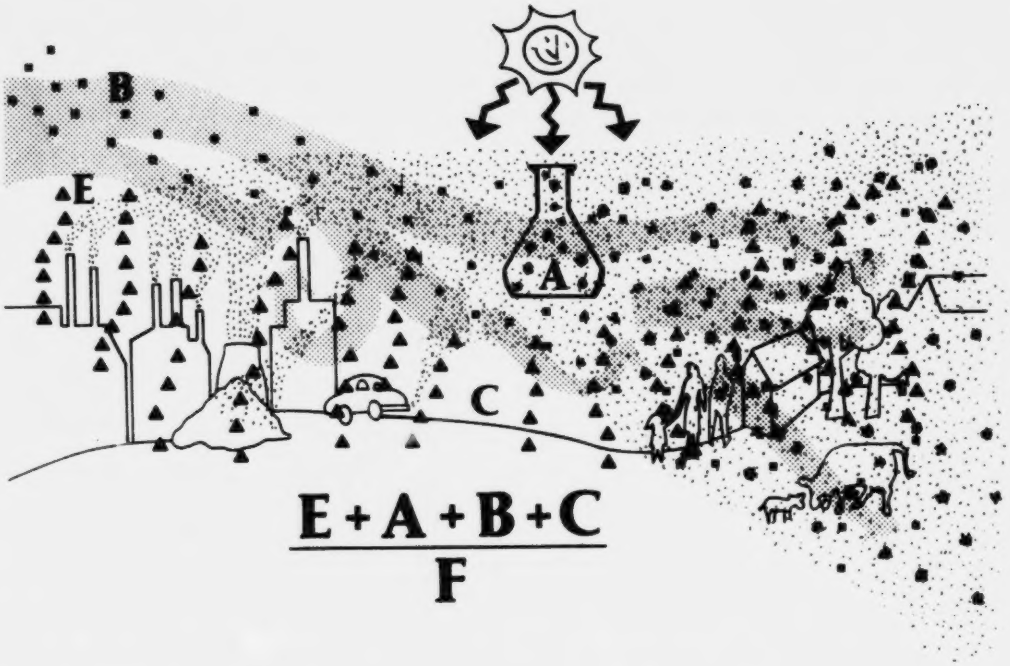


Figure 1-1. Ambient Air Quality Model

Chapter 2

Role of the Field Enforcement Officer

THE ROLE OF THE FIELD ENFORCEMENT OFFICER

Goal

To describe the job characteristics of the FEO, his necessary personal qualities, and how he works to become outstanding in the performance of his assigned duties.

Objectives

At the end of this lesson, the student should be able to:

1. State the role of the field enforcement officer,
2. State three job-related requirements a newly hired FEO must learn,
3. State what determines the scope of the field operations program,
4. State at least five field enforcement activities,
5. Identify at least five specific characteristics of the FEO's job,
6. State at least three methods of continuing self-education by day to day working experience,
7. List at least four personal qualities or skills needed by the FEO, and
8. Identify three nonverbal influences in communications.

Selected Reading

Reference 4, APTD-1100, Chapter 1, Sec. VII.

Reference 9, Communication for Justice Administration, Chapters 1, 2, and 3.

THE ROLE OF THE FIELD ENFORCEMENT OFFICER

Introduction

This chapter describes, in a general way, the job of the field enforcement officer and the necessary personal qualities of the FEO to enable him to satisfactorily perform his duties.

Role of the Field Enforcement Officer

Field enforcement officers are responsible for those control agency functions which are designed to achieve the desired level of air quality by limiting emissions. They constitute the primary field operation arm of the control agency.

The FEO represents the agency in the field. He deals directly with people and often he *is* the agency in the eyes of the general public. The ultimate success or failure of the enforcement program depends heavily upon how well the FEO does his job.

Scope of the Field Operations Program

A. External Determinants

The major external determinants are the number and types of stationary sources that require surveillance and the status of compliance with the regulations, compliance plans, consent orders, etc., related to such sources.

B. Internal Determinants

The major internal determinants are: (a) the complexity of the rules and regulations (b) the support for source registration and permit inspections (c) the frequency of required re-inspections; and (d) administrative and enforcement policies of the agency.

C. Agency Level Influence

The extent of the FEO's job differs somewhat among agencies but the level of the agency, i.e., local, state or federal, has a marked influence on the field duties assigned to the FEO.

1. ***The local agency (city, county, regional, or district office of a state agency)***

   Field Enforcement responsibilities at the local level generally involve the supervision of a wide variety and large number of sources. The FEO is physically close to the pollution sources and to the citizens who expect prompt response and action on complaints. In cases of litigation, often the FEO has little advance consultation with legal counsel.

2. ***The state agency (operated entirely from a central headquarters)***

   Enforcement officers are farther removed from sources and the people, requiring greater travel and less frequent inspections. Enforcement is more structured to the larger sources than in areas of small local agencies or state agencies having district offices.

3. ***The federal EPA***

   At the federal air pollution level, emphasis is placed on enforcement on larger (major sources as defined by the CAA) stationary point sources of criteria pollutants; is usually structured with legal consultation on a case by case basis and often, but not always, dual with the state or may preempt the state. Under certain conditions, the Clean Air Act now mandates litigation. Some federal field inspectors are responsible for both air and water pollution enforcement.

Field Enforcement Activities

The tasks assigned to the FEO may include one or all of the following: (a) field surveillance of sources and complaint investigation; (b) source facility inspection; (c) report writing, composing orders, recommending or serving notices of violation; (d) assisting in developing a formal compliance plan; (e) serving as a witness before a hearing board or a court; (f) assisting in technical operations, such as source testing or collecting samples; and (g) functioning during an air pollution alert or emergencies.

Characteristics of the Field Enforcement Officer's Job

The FEO's job is both people and situation oriented. Field personnel must deal with the motivations, needs and problems of individuals and with other environmental, economic, legal, and social considerations that are encountered almost daily in the field.

The FEO is: (a) constantly meeting and dealing with people face to face, (b) obtaining information, (c) conducting investigations, seeking provable, factual evidence, (d) answering questions and solving problems, (e) forming judgments, (f) taking enforcement actions, (g) preparing and preserving the record in written reports, and (h) giving persuasive testimony.

An unusual person is required to handle such a variety of duties with the skill and diplomacy to attain the desired results—compliance in the shortest time and minimal litigation.

Personal Qualities and Skills

The FEO should possess a mature personality, capable of dealing with the public in an efficient and businesslike manner, often under strained conditions. He is courteous but firm. At times, he must listen to caustic comment and criticism with self control to avoid argument or debate. He must, in such circumstances "keep his cool."

Ability to communicate is essential.

The Spoken Word

Since words are tools of the trade for the FEO, he should be aware of the following:

- Communicating is more than a matter of people talking to each other. Be sure the other party understands the full meaning and import of what you say and what you may want him to do.
- The right words communicate. The wrong words may well irritate.
- Effective communications may well be the lubricant that can prevent friction between violator and enforcer.
- Avoid ordering or commanding. "Do this! Do that!" "Because I say so, or because the law says so."

Nonverbal Influences

The spoken words are by no means the sum total of communications. The nonverbal influences can be just as important. How the FEO acts, dresses, the level of his calmness and self-assurance, are all part of effective communications. Don't make it tough on yourself by going into an interview with a chip on your shoulder and show it.

Appearance

Dress and appearance play a major role in the acceptance of the FEO and his spoken word. He must be neat in appearance and well groomed. This may be hard to achieve but is nonetheless necessary. Alternating situations of office and plant, clean and dirty, heat and cold must be accommodated. The preferred outer dress for the president's office is a suit or a sport jacket, but the plant inspection requires rough clothing. So, dress for the president's office and carry protective clothing in the car.

A suggested list of outer wear is: (a) your own hard hat, identifying your agency; (b) protective eye glasses; (c) lightweight overshoes; and (d) shop coat or oversized overalls.

The City of Philadelphia, Standard Operating Procedures, memorandum to inspectors, February 14, 1976 states:

> "Proper attire is required at all times on the job. A tie is necessary always and a suit coat or sports jacket must be worn. If the weather is uncomfortably hot, the coat may be removed, but it should be available, i.e., in the car so that it can be worn if the situation should require it. Exceptions to clothing requirements are made for inspectors on night shifts or special (dirty) details."

Investigative Skills

The FEO must develop investigative skills in gathering facts and organizing them in a concise manner. He must be: (a) observant of signs important to the central theme of his inspection or investigation; (b) resourceful and thus apply innovative methods to unusual situations; (c) able pick out from the sum total of conversation and directed inspections that which is meaningful to his purpose; and (d) skillful in directing the interview and inspection to obtain the factual material he needs.

Capacity for Learning

In order to develop the qualities needed, the FEO must have a capacity for learning in the technical and legal disciplines. The technical aspects encompass a broad understanding of the whole field of air quality management and source control technology. He must be able to speak the language of air pollution and its control. The FEO should use each inspection, especially on new construction permits, as a learning process. The doctors and lawyers practice and so should the FEO.

Potential for Legal Enforcement

The FEO must develop a potential for legal enforcement. At all times he must be able to, from his own memory and aptitude, relate regulations by number to corresponding situations encountered in the field. In some cases, the FEO must align with a prosecuting attorney who is unfamiliar with the air pollution statutes, who may have very little knowledge or experience in air pollution cases and who may have little time for advance preparation.

The FEO Functions as a Member of a Team

Notwithstanding, the central role of the FEO in an enforcement action, especially in the larger and more complicated litigations, the FEO must fully develop rapport with the engineering and technical groups, as his role supports them and vice versa.

Orientation and Training

The Newly Hired FEO

In his first weeks on the job, the FEO must: (a) learn the air pollution laws and regulations including the section numbers which will be enforcing; (b) learn the administrative procedures, especially the paperwork routines; and (c) the policies of enforcement.

Continuing Technical Training

His training must: (a) enhance his basic knowledge of the combustion process and equipment operation; (b) include the identification of industrial processes and control equipment and the parameters which relate to emission potential (he should concentrate on the source types in his assigned territory); (c) gather reference texts to develop a personal technical library for ready reference; and (d) attain expert status in the reading of opacity.

Continuing Education

Opportunities include: (a) available EPA self-instructional courses; (b) specialized EPA training courses; (c) appropriate technical meetings; (d) specialized college courses; (e) seminars and conferences sponsored by the agency for exchange of information; (f) selected reading of professional journals and informational materials.

Summary

The FEO's job is both people and situation oriented. He performs a wide variety of tasks. He holds the key to a successful enforcement program. He is the principal witness to a noncompliance situation.

How the FEO does his job, in a great measure, characterizes the agency and the program in the eyes of the public. While most programs strive to obtain compliance without recourse to litigation, the FEO should make every action count as though it will, some day, become part of a court case.

Chapter 3

The Enforcement Process

THE ENFORCEMENT PROCESS

Goal

To present an overview of the enforcement process by which sources are brought into compliance and so maintained. Emphasis will be on the functioning of the FEO within the process.

Objectives

At the end of this lesson, the student should be able to:

1. State the mission of the enforcement operation of an agency.
2. Identify three major enforcement systems.
3. State at least six ways construction permits aid enforcement.
4. Identify the Federal jurisdiction for new construction permit review.
5. State the purpose of a "Policy of Enforcement."
6. State the three degrees of compliance.
7. State at least eight of the milestones included in a Compliance Plan Schedule.

Selected Reading

Reference 4, APTD-1100 Chapter 2, Section I and III
Reference 8, Course SI 422 – Enforcement Systems

THE ENFORCEMENT PROCESS

Introduction

Enforcement actions vary widely among agencies. Policies selecting the enforcement strategy are as individualistic as the agencies themselves. This chapter presents the many and varied enforcement mechanisms. It is hoped this chapter will widen the FEO perspective of enforcement even though he is not free to choose, on his own beliefs, from the mechanisms available. He is, or should be, directed by agency policy in such matters.

Mission of Enforcement Operations

The mission of the enforcement operations of an agency is to carry out those field operational tasks designed to bring all sources into compliance with the regulations at the earliest possible time and to so maintain them.

Enforcement Systems

Control strategies are woven into four enforcement systems for implementation: (a) permits to construct and initially operate, (b) permits to operate which generate periodic reinspection on a scheduled basis, (c) compliance plan enforcement, and (d) surveillance and complaint response.

Permits to Construct and Initially Operate

A. Purpose

The purpose of the permit regulation is to prevent construction of a new stationary source or modification of an existing source if emissions from the source at the proposed site would: (a) result in a violation of the applicable portions of the control strategy, (b) prevent attainment or maintenance of one or more of the National or State Ambient Air Quality Standards; and (c) cause significant deterioration of air quality which is currently better than that required by the National or State Ambient Air Quality Standards.

B. Jurisdiction

Permit systems are administered by either local, state and/or federal agencies depending on local or state regulations and the source category related to the Clean Air Act (CAA).

Usually all sources that have significant emission potential are included in state and local permit regulations.

Implementation Plan — Section 110 of the CAA now requires that all approved State Implementation Plans have a permit system for any major emitting facility relating to the provisions of Part C (Prevention of Significant Deterioration) and Part D (Nonattainment areas) of the Act. A major emitting facility is defined as any stationary facility or source which directly emits, or has a potential to emit, one hundred tons per year or more of any pollutant (including any major emitting facility or source of fugitive emissions of any such pollutant).

The 1977 Amendment to the CAA added a complete new dimension to the involvement of the Federal EPA in the review process for permit to construct.

The requirements apply to major sources to be constructed in PSD and nonattainment areas. Federal review applies to: (a) PSD areas for any source having an emission greater than 250 TPY or 100 TPY for 28 specified sources, and (b) nonattainment areas for any source which has an emission greater than 100 TPY. The details of the EPA permit requirements will be covered in Chapter 6.

In most agencies, the administration of the permit system is in the hands of the professionally trained engineers. They are responsible for evaluating applications for permits, making calculations necessary for determining probability of compliance with air pollution laws and making decisions on the approval or denial of permits. Once a permit has been granted, it is the duty of the FEO to maintain assurance that the applicant is complying with all the requirements of the permit document.

C. Registration

For sources not requiring federal permit, some agencies use "registration" instead of "permits". Some, as in Ohio, use state permits for all but minor sources, and "registration" for said minor sources (less than 25 T/year potential).

Registration processing is similar to permit processing except preconstruction review and approval is not required.

D. Enforcement Benefits

The permit and registration systems aid enforcement and may also aid the applicant by: (a) providing for engineering review prior to construction, so that any necessary changes can be made with less cost than after construction begins (not applicable to registration); (b) preventing construction before it starts if the new source does not comply in all respects; (c) requiring, if needed, that the permit document highlight parameters which are important to proper functioning of control equipment; (d) insuring that required emission monitors will be installed; (e) requiring in some cases that the permit document include an operations and maintenance program; (f) denying operation permits so that the source cannot legally operate until it is in compliance if inspection or tests show noncompliance; (g) giving notice of change—adding new sources; (h) keeping the emission inventory up to date; (i) acting as a good continuing training program, where the FEO does field inspection, allowing him to see good equipment as it is being constructed.

E. Overview

The three Permit Systems, Permit to Construct and Certificate to Operate, Certificate to Operate (initially), and Registration System, are shown on the flow diagrams in Figure 3-1.

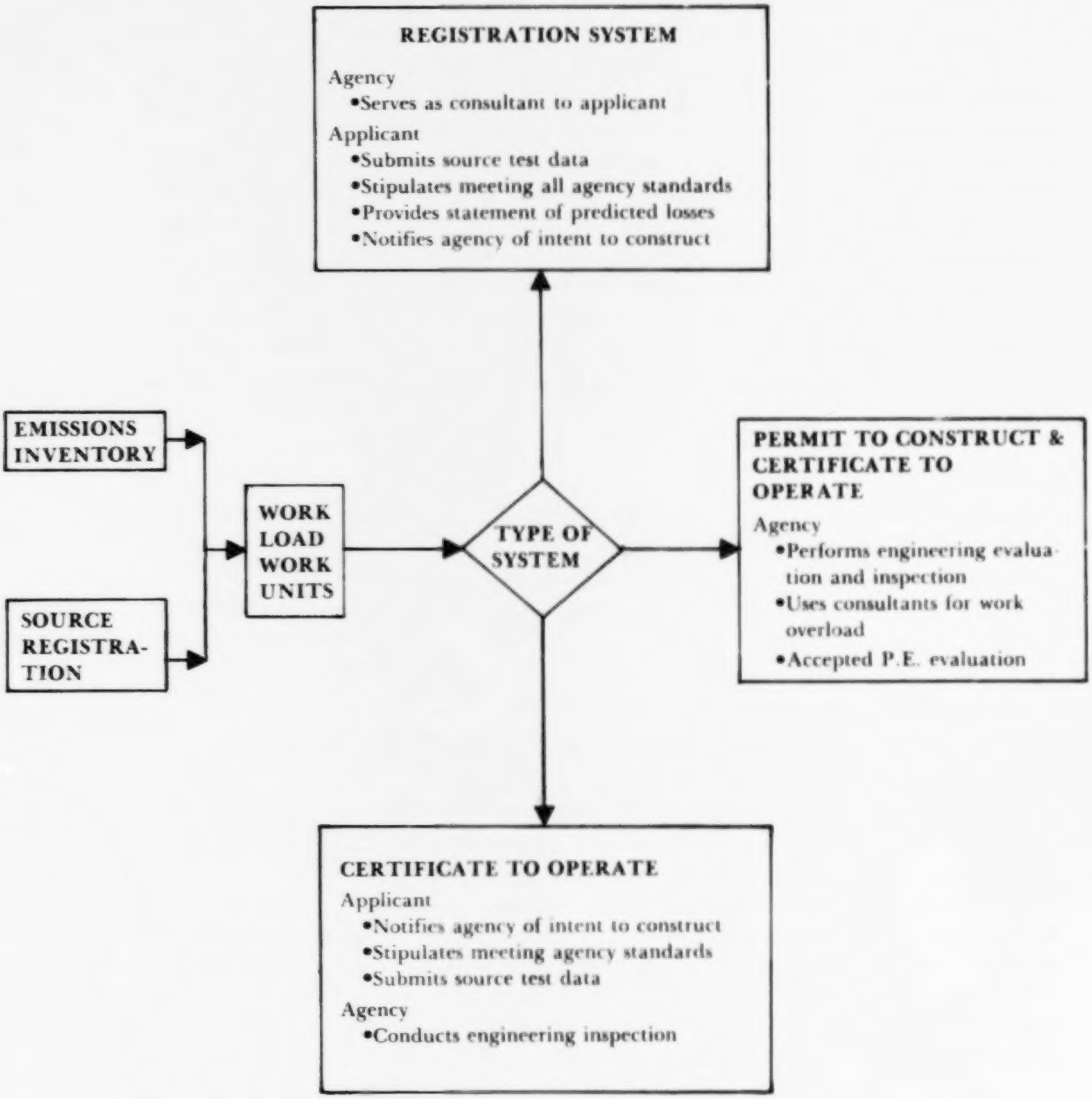

REGISTRATION SYSTEM
Agency
•Serves as consultant to applicant
Applicant
•Submits source test data
•Stipulates meeting all agency standards
•Provides statement of predicted losses
•Notifies agency of intent to construct
EMISSIONS INVENTORY
SOURCE REGISTRATION
WORK LOAD WORK UNITS
TYPE OF SYSTEM
PERMIT TO CONSTRUCT & CERTIFICATE TO OPERATE
Agency
•Performs engineering evaluation and inspection
•Uses consultants for work overload
•Accepted P.E. evaluation
CERTIFICATE TO OPERATE
Applicant
•Notifies agency of intent to construct
•Stipulates meeting agency standards
•Submits source test data
Agency
•Conducts engineering inspection

Figure 3-1. Schematic reproduction of analysis for engineering manpower for a permit system.

Cyclic Operating Permits

Requiring sources, on a regular time cycle, such as every year, or every two years, to file applications for renewal of the operating permit is a strong enforcement tool. The purpose is to set up a scheduled review of all sources, usually on a class-by-class basis (all asphalt paving plants, all combustion sources greater than "x" Btu per hour input, etc.) and reissue or deny an operating permit where compliance or noncompliance is the result of the reevaluation process.

Cyclic operating permits aid enforcement by

1. Subjecting sources to periodic review;
2. Where noncompliance is in evidence, denial of operating permit, adding "clout" to the overall enforcement program by making operation of the source per se a violation;
3. Providing a periodic update of the original permit documents such as: ownership change, process change, materials change, etc., which would require a new construction permit;
4. Providing a systematic check of all emissions by
    (a) Observing for visible emissions,
    (b) Inspecting emission monitors and control device instrumentation,
    (c) Reviewing recorded emission data, and
    (d) Inspecting control processes for conformity with good maintenance procedures;
5. Updating the emission inventory;
6. Exposing plant personnel to the presence of FEO and the importance of operating in compliance.

Compliance Plan Inspection

A. Purpose

The purpose of the compliance plan inspection is to inspect progress toward the specific "milestones of a Compliance Plan, Administrative Order, Court Order or a Section 113(d) Delayed Compliance Order" (for DCO procedures see page 12-5).

Many agencies will formalize administrative orders into negotiated compliance plans. Compliance plans may also be generated in cases brought before a hearing board or into an appropriate court of law. Once such plans are negotiated or directed, their implementation is subject to verification by onsite inspection.

Important parts of the compliance plan are the scheduled completion dates, entered into the plan of recognizable milestones indicating progress toward the ultimate compliance status. The compliance plan should always include a specified penalty for failure to meet the various and significant completion dates.

B. Compliance Plan Schedule

A compliance plan for the construction or reconstruction of a major control facility would include the following milestones:

1. Engineering study, pilot studies and source testing to generate process and emission data, and cost estimates.
2. Approval of funds by management (Board of Directors),
3. Completion of final design, bids taken and best proposal selected,
4. Approval of APC Agency. Construction permit secured,
5. Order placed for equipment,
6. Delivery of equipment,
7. Installation and "shake down" runs,
8. Source test for compliance,
9. Operating permit secured,
10. Turned over to operating department.
    (It now becomes the object of re-inspection for operating permit renewal and surveillance.)

The city of Philadelphia, Enforcement Procedures Appendix 10 contains an example of a form for an Emission Abatement Action, Compliance Schedule Summary. See Table 3-1.

C. Enforcement Benefits

A well monitored compliance plan materially benefits because:

- Time slippage can be spotted and action taken to increase the tempo of the compliance program.
- Valuable time is saved in generating legal compulsion if there is no action or gross deviation from time schedule.
- Penalties for noncompliance are visible to the owner.

Surveillance and Complaint

A. Surveillance

Surveillance is accomplished by a program of looking for observable violation within the FEO's assigned district. Observations are from outside the source boundary and are on a random basis or according to a schedule by time or source class.

Surveillance should be around-the-clock where conditions and agency personnel permit and might include surprise onsite inspection. The surprise onsite inspection would be in addition to the cyclic operating permit inspections.

B. Response to Citizen Complaint

Response to citizen complaint is a significant part of the FEO's job. A complaint can involve a specific violation such as visible emission, or it can and often does relate to nuisance.

Complaint management will be covered in Chapter 11.

APPENDIX 10
AIR MANAGEMENT SERVICES
EMISSION ABATEMENT
COMPLIANCE SCHEDULE SUMMARY

Firm name and address:

Process, operation or activity related to compliance schedule:

Name, title and address of company official authorizing compliance schedule:

Name, title and address of person completing summary:

Date of preparation of summary:

A. Type of abatement activity to be undertaken. (Check one or more categories below, as appropriate. Use separate summary form for each process, operation or activity to be covered by a compliance schedule).

☐Process/equipment change or modification
☐Maintenance or operational change
☐New control equipment installation
☐Additional control equipment installation
☐Modification to existing control equipment or appurtenances
☐Installation of instrumentation or automatic controls
☐Cessation of process, operation or activity
☐Other

B. Description of Abatement Activity(ies). (Give general description of abatement activities as indicated in "A" above.)

C. Compliance Schedule Profile. (Indicate projected completion date adjacent to activities below which pertain to the compliance schedule to be undertaken.)

1. Engineering studies to be completed by:
2. Pilot studies or tests to be completed by:
3. Appropriations requested by:
4. Appropriations approved by:
5. Permit application to be submitted by:
6. Purchase order to be issued by:
7. Control equipment to be delivered by:
8. Auxiliary equipment, instrumentation or controls to be delivered by:
9. Control equipment installation completed by:
10. Process/equipment change or modification completed by:
11. Maintenance or operational changes to be instituted by:
12. Control equipment modification completed by:
13. Startup or operation to commence by:
14. Cessation of process or operation by:

**D. Effect of contingencies on completion of compliance schedule
(Indicate any known or contemplated contingencies which could effect the time schedules as listed in "C" above.)**

Signature and title of authorizing company official:

Table 3-1. City of Philadelphia compliance schedule summary.

Degrees of Compliance

All sources are not always in or out of compliance now and forevermore. The status of compliance can fall into one of three categories:

1. Continuing Compliance – The source is equipped and will operate continuously with great assurance that it will be within the regulations. Requires minimal surveillance – a good source.
2. Functional Compliance – A marginal source in compliance at time of observation or inspection, but little assurance of long term compliance.
3. Noncompliance – Violation conditions, supported by valid evidence justifying enforcement action.

Enforcement Actions

Enforcement action must be taken whenever the FEO establishes all of the facts and gathers evidence to prove the occurrence of a violation of the rules and regulations, a permit to construct or operate, the terms and conditions of an order, or a compliance plan. The objective of enforcement is to bring all sources which are in violation into a continuing compliance status as soon as possible.

A. Enforcement Actions Available

Enforcement alternatives range from voluntary compliance on source initiative or upon specific notice to comply to "file legal action first and talk later". Most agencies operate somewhere in between, depending upon the circumstances of the violation, the agency resources, the specifics of the statutes, and the availability and effectiveness of legal assistance including the judicial processes of the area.

Enforcement procedures are:

1. Notice of violation with administrative orders to correct. Used for first offenders and for relatively new requirements.
2. Administrative conference or hearing leading to a formal administrative abatement order and an agreed to compliance schedule.
3. Citation tickets which are paid, without court appearance, similar to traffic tickets.
4. Administratively imposed penalties according to a schedule of fines and penalties.
5. Civil or criminal suits leading to imposition of fines and other punishments and/or judicial orders incorporating specific compliance plans.
6. Court ordered injunctions to stop the violating practice.
7. Administrative revoking of permits to construct or permits to operate, making further work or operation unlawful.

See Chapters 7 and 8 for the details on the enforcement procedures.

Enforcement Policy

In the preceding section, seven enforcement mechanisms available to the agency are given. It will also be shown in Chapter 5 that several different procedures can be used for serving a notice of violation. Choice of enforcement action and notification methods are handed down to field personnel as a policy of enforcement.

Agencies nearly always have more than one FEO and some may have as many as 20 or 30 officers enforcing the same regulations. Only by having a clearly defined enforcement policy or an established set of enforcement procedures will FEOs working in the field have the guidance to react to like situations uniformly.

Once established, the enforcement policy and procedures are communicated to the field officers by

- written directives
- verbal instructions from supervisors
- meetings of FEOs with supervisors
- word of mouth from other FEOs.
- by distribution of case summaries which show proper selection of mode of attack.

Summary

All enforcement actions have a common objective to secure a condition of continuing compliance of sources.

For emphasis, for the very first contact, each action, each record, each notice, should be part of a carefully designed case record which will assure successful prosecution of a case in a court of law even though the policy of the agency is cooperation. When this is done, voluntary compliance works best and if it fails, judicial decisions in the courts will be favorable.

Chapter 4

Offsite Surveillance, Opacity, Documentation

OFFSITE SURVEILLANCE, OPACITY, DOCUMENTATION

Goal

The purpose of this lesson is to bring into focus that element of the enforcement program which seeks out violating conditions by surveillance of a district, surveillance of a limited area by simplified instruments or effects indicators. The elements needed to establish a violation and how they apply to opacity surveillance are included.

Objectives

At the end of this lesson, the student should be able to:

1. State at least five different violating conditons sought out during surveillance.
2. Explain three different ways surveillance is exercised.
3. When testing an occurrence, state at least five questions to be answered to prove a violation
4. Identify the point of observation of a plume for visible emission evaluation.
5. Differentiate between water vapor and particulate opacity in a plume from a source.
6. Demonstrate how to properly document a visible emission violation.
7. Explain the meaning of a "certified smoke reader."
8. Define "opacity."
9. Explain the Ringelmann chart method of determining smoke density.
10. From a set of opacity readings, determine compliance or violation with a given set of regulations.
11. Identify some of the more simplified evaluation by effects, such as:
    a. adhesive capture of nuisance particles
    b. use of high volume sampler
    c. effect on sampling materials

Selected Reading

Reference 4, APTD-1100 - Chapter 2, Section III, Chapter 4. I. II, III, IV.

Reference 12, Air Pollution, Stern, Edition 3, Volume III, Chapter 10, Air Pollution Effects Surveillance.

Reference 11, EPA Standards of Performance for New Stationary Sources, Appendix A, Method 9.

OFFSITE SURVEILLANCE, OPACITY DOCUMENTATION

Introduction

This unit of study is to bring into focus that element of the enforcement program that seeks out violating conditions by surveillance, either generally or for special purposes. Special purpose surveillance may require the use of simplified instrumental sampling devices or effects indicators. In this unit, the elements of a violation are desribed. The FEO must apply these principles both during offsite surveillance and source inspection.

Surveillance Principles

Surveillance is the field operation which provides for the observation and detection by sensory perception, sight or smell, of events which in themselves are violations or which strongly indicate noncompliance conditions within a source facility, requiring prompt investigation by the FEO.

Surveillance is carried out by: (a) systematic observation of the activity in an assigned district; (b) by a single source observation prior to entering a facility for inspection, and (c) by monitoring an area with low cost, uncomplicated instruments or procedures which produce quantitative or qualitative data.

In both general and preinspection surveillance, the following are some of the observable manifestations that are sought and recorded:

- Plumes of readable opacity,
- Fugitive emissions from source operations such as materials handling, quarrying, crushing, construction, demolition, etc.,
- Large particle fallout,
- Evidence of plant damage,
- Obnoxious odors, especially if citizen complaint has been received,
- New facility construction, expansion or modification for which a permit may not have been obtained.
- Open fires where prohibited,
- Change of ownership without new owner obtaining a required certificate of operation.
- Illegal fuel delivery where fuel use is regulated.

District Surveillance

District Surveillance is carried out:

1. By having the FEO spend part of his field time on "patrol."

   A few larger agencies assign special enforcement officers in uniform to exercise surveillance and investigate complaints.

   Examples: Southern California Air Management District in emergency type vehicles for specialized patrols. Southwestern Ohio Air Pollution Control District for mobile source violations and open burning, also in emergency type vehicles.

2. Exercising surveillance when in the field on other assignments, going from job to job.

Field Patrol

Vehicle patrol is the principal surveillance method. Field enforcement officers drive their vehicles throughout a defined area such as a zone, sector or district, to observe visible and other evidence of emissions and to detect possible violations of the rules and regulations.

As the enforcement officer becomes familiar with his district, he concentrates on sources requiring the greatest attention, and on areas of high source density. He may employ a checklist of facilities that are currently involved in permit cases, hearing board actions, recurrent violations or complaints.

Air pollution conditions can become a problem due to fog and atmospheric stagnation periods, often occurring during the evening and early morning hours. Many nuisance complaints are reported during the evening since individuals wish respite from any form of pollution during their leisure hours. The scheduling and deployment of enforcement personnel to after-hours surveillance will depend on information on complaints, knowledge of the sources in the individual districts and data on hours of operation.

Preinspection Surveillance

The FEO is heavily engaged in source inspection for a variety of reasons, such as checking on construction and cyclic operating permits, checking progress on compliance plans, investigating complaints, etc. (See Chapter 5.) Prior to entering the source facility, the FEO conducts a single source surveillance, allotting the necessary time to thoroughly check the potential nonconforming activity and look for other signs which might influence the facility inspection strategy.

A preferred plan is to seek a vantage point where the entire facility can be observed. Since this may be some distance from the source, binoculars will assist in viewing the detail operations and reading signs which might be significant. If a vantage point is not available, drive around the facility to cover as much as can be viewed from the surface.

Following the preentry surveillance, the inspection plan is reviewed to include any changes made necessary by what is observed.

Surveillance by Instruments or Effects Indicators[12]

A. High-Volume Sampling

Some air pollution control agencies are faced with the necessity of enforcing "fence line" standards, the most notable being total suspended particulate matter. Because of the difficulty of sampling, the use of this type of standard is diminishing. However, where still in effect, the TSP "fence line" standard is monitored for compliance by placing high volume samplers upwind and downwind from the source. The FEO is frequently called upon to change the filter daily.

B. Ambient Adhesive Impactor

Identifiable wind blown particulates, 20μm and larger, can be captured on 2 in. strips of adhesive-coated paper wound vertically around glass cylinders, (2-3/4 inches in diameter and 3-1/4 inches high), inverted and held by the jar lid fastened to a suitable stand.

A suitable contact paper is Fassons Pli-a-print, R135. The vertical exposed sticky surface captures the particles on the sampler face that looks at the source. Because samples and stands are inexpensive, many impactors can be used in a survey of a single source. The particle catch is evaluated by particle counting or by using a particle comparator.

C. Effects Indicators

A large number of materials react or interact, yielding a noticeable change in their appearance or properties. Perhaps the most notable effect is the discoloration of lead-based paint by H_2S.

Vegetation effects can monitor a wide range of gases grouped as oxidants (ozone, PAN, and NO_2), sulfur oxides, ethylene, and associated olefins, chlorine, and ammonia. Episodal release of such gases will leave telltale damage and the area of effect of the release can be readily traced by plotting the location of observed vegetation damage.

Some agencies develop a checklist of vegetation damage within their region. Such a list is then translated to a log for checkoff by the FEO, during general or preinspection surveillance operations.

Enforcement of Visible Emission Regulations

A. Introduction

Limitation on opacity emissions will be a strong part of any enforcement program for many years. It is a means of limiting the aerosol emission by direct reading. The degree of opacity cannot be equated to a mass emission limitation, except on a source by source basis where particle size distribution within the plume does not change, or where there is no concentration change by the addition of a dilutent. However, there may be occasions when the FEO will have suspicions of a mass emission violation, even though there is no opacity violation. For example, this may be apparent when the FEO has the opportunity to refer back to source test data on the facility where, at the time of the test, the opacity was recorded as being barely visible when at the same time, the test showed it just barely passed the mass emission regulation. If, at a later date, he sees no visible emission violation, but a slightly higher opacity than that which occurred during the test, say 10 percent, he should be suspicious of a mass emission violation. In this case, he may want to request another test proving the source has not taken immediate corrective action.

Opacity is a direct measure of the contribution of fine particles to the haze in the atmosphere and its limitation serves well in the overall program of air quality improvement.

B. The Plume

The plume is the contaminant-laden gas stream from a specific outlet such as a stack or vent. The plume, particularly when it is distinctly visible, is characterized by (1) a point of release and formation just at the outlet of a stack or opening of a closed system, or a few feet above the outlet in the case of a "detached" plume, (2) the body or stream, carrying relatively concentrated contaminants, confined by the momentum of the escaping gases and sometimes (3) a point at which the plume appears to dissipate (see Figure 4.1).

The point of discharge of the emission, or the point of maximum opacity, is the point at which the opacities of visible emissions are read. The point of dissipation is important in determining whether or not the plume is a contaminant, water vapor or steam, or some combination of both. Depending on wind velocity, humidity and temperature, condensed water vapor or steam may dissipate more rapidly than contaminants contained in the plume. Where most of the effluent appears to consist of water vapor, the opacities or densities of the contaminants are read at the point of dissipation or evaporation of the steam.

C. Plume Evaluation

Once a plume is identified as an air contaminant, it must be measured by some standard to determine whether or not a violation of the regulation has occurred.

For measurement of the effluent plume, all Federal regulations, and most state and local jurisdictions, use "opacity" and the "Ringelmann Chart." Opacity can be applied to plumes of any color while the Ringelmann Chart measures smoke density as shades of gray.

D. Principles of Opacity and Smoke Reading

The most widely used reference method for determining opacity is the EPA Method 9 (40CFR60) (Ref. 11). A companion document is the EPA publication, Guidelines for the Evaluation of Visible Emissions, Certification, Field Procedures, and Background Material (1975) (Ref. 15). Reproduction of "Guidelines" is included in this section starting on page 4-24 because of its importance to the FEO.

Structure of a Plume

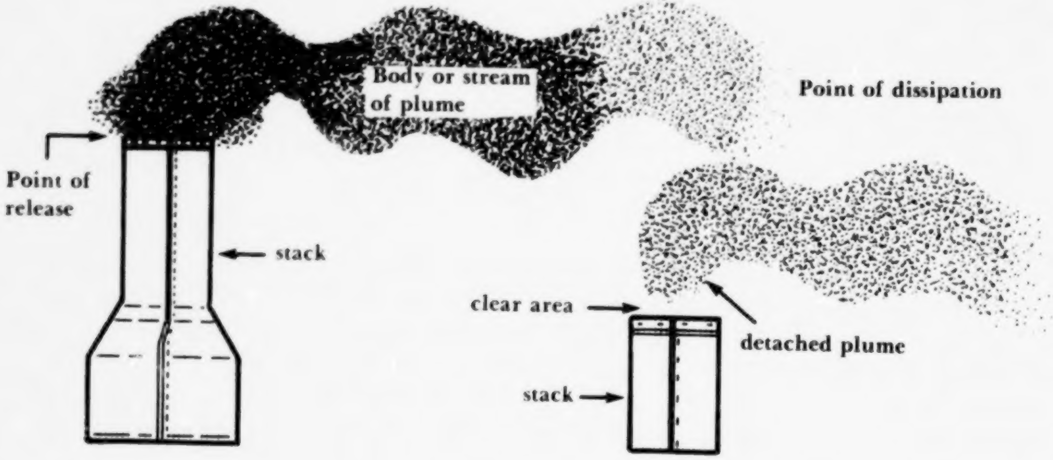


Figure 4-1. General structure of continuous and detached plumes. (Source: Weisburd, (Reference 4)

The definitions of the terms "opacity" and "smoke density" are rather simple, as they are limited by the law and the nature of the Ringelmann Chart.

1. ***Opacity***

   The term "opacity" means the degree to which transmitted light is obscured. The degree of opacity is usually rated directly in percentage of perfect transparency, and 100 percent opacity being perfectly opaque.

2. ***Smoke Density***

   "Density" means the "quantity of anything per unit of volume or area," as defined by Webster's Dictionary. An examination of the Ringelmann Chart discloses the obvious fact that the shades of gray smoke are reproduced according to the ratio of the area occupied by the black grid lines to the total area of each card, and are expressed as the percent of each card blackened.

   Since the black grid lines represent opaque area, and the white spaces the area through which light is transmitted, it is implicit in the design of the Ringelmann Chart that "smoke density" can only be defined as a measure of degree of opacity. This definition does not imply any relationship with the definition which might be made in terms of "weight per unit volume."

E. Reading and Documenting Opacity

The guidelines section, starting on page 4-24, contains a complete set of instructions for reading and documenting opacity. It should be studied and understood by the FEO who is enforcing visible emissions on the basis of opacity. The student should consider it an important part of the text of this manual.

F. Reading Smoke Density by the Ringelmann Chart

The history, description and general use of the Ringelmann Chart is discussed in the Bureau of Mines Information Circular – (Reference 39)

> ***Method of Preparing the Chart***
>
> The Ringelmann system is virtually a scheme whereby graduated shades of gray, varying in five equal steps between white and black, may be accurately reproduced by means of a rectangular grill of black lines of definite width and spacing on a white background. The rule given by Professor Ringelmann by which the charts may be reproduced is as follows:
>
> Card 0 – All white.
>
> Card 1 – Black lines 1 mm. thick, 10 mm. apart, leaving white spaces 9 mm. square.
>
> Card 2 – Lines 2.3 mm. thick, spaces 7.7 mm square.
>
> Card 3 – Lines 3.7 mm. thick, spaces 6.3 mm. square
>
> Card 4 – Lines 5.5 mm. thick, spaces 4.5 mm. square
>
> Card 5 – All black.

The chart provides the shades of Cards 1, 2, 3, and 4 on a single sheet, which are known as Ringelmann No. 1, 2, 3, and 4, respectively. Figure 4-2.

G. Relating Ringelmann Numbers and Opacity

1. Black smoke is read in densities and recorded in Ringelmann numbers.
2. All opacity readings correspond to densities on the Ringelmann Chart in the following manner:

RINGELMANN	OPACITY
#1	20%
#2	40%
#2½	50%
#3	60%
#3½	70%
#4	80%
#4½	90%
#5	100%

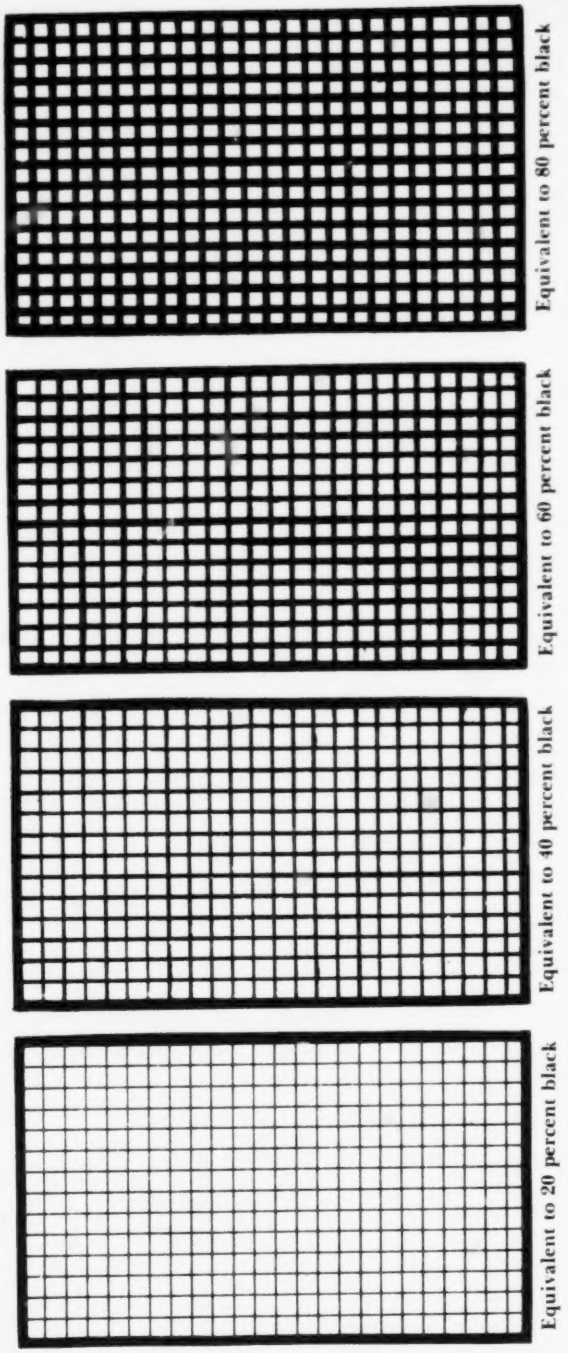

Equivalent to 80 percent black
Equivalent to 60 percent black
Equivalent to 40 percent black
Equivalent to 20 percent black

Figure 4-2. Ringelmann's scale for grading the density of smoke
(Reference 39)

H. Data Reduction

To determine average smoke emission over a relatively long period of time, such as an hour, observations are usually repeated at one-fourth or one-half minute intervals. The readings are then reduced to the total equivalent of No. 1 smoke as a standard by multiplying the total of units in each R reading by the Ringelmann number. Example: 32 units of 3R = 32 × 3 or 96 Equivalent Units of No. 1. Number 1 smoke being considered as 20 percent dense, the average "density" of the smoke for the entire period of observation is obtained by the formula:

$$\frac{\textit{Equivalent units of No. 1 smoke} \times 0.20}{\textit{Number of observations}} = \textit{average smoke density}$$

J. Adaption of the Ringelmann Chart for Field Use

Two miniature Ringelmann Charts are available commercially:
(a) The Pocket Air Pollution Indicator and (b) The Powers Micro Ringelmann Chart. If either of the hand held charts are to be used as testimony, then the regulations must describe the Indicator or Micro Ringelmann Chart as the standard method.

K. Reading Smoke in the Field (From References 4 and 15)

The following general rules apply to sight-reading plume densities or opacity in the field. (See Figures 4-3, 4-4, and 4-5.)

1. ***Reading Air Contaminants***
   a. Line of sight must be unobstructed.
   b. Light source should be in a 140° sector to the rear of observer during daylight hours.
   c. Light source should be behind plume during hours of darkness (transmitted light).
   d. Readings should be made at right angles to wind direction and from any distance necessary to obtain a clear view of stack and background.
   e. An inspector should not study the plume as this will soon produce fatique and cause erroneous readings. Instead, he should glance at the plume and record his observation immediately, looking away from the plume between readings. Method 9 specifies one reading every 15 seconds.
2. ***Recording Air Contaminants***
   a. Readings are recorded in the appropriate space on the report or notice form as taken.

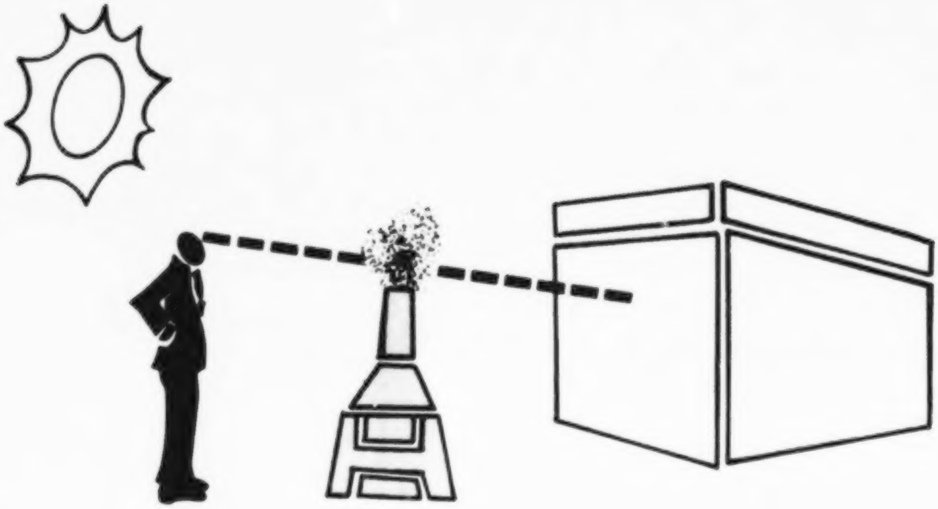


Figure 4-3. Light source should emanate from the rear of observer during daylight hours (reflected light).

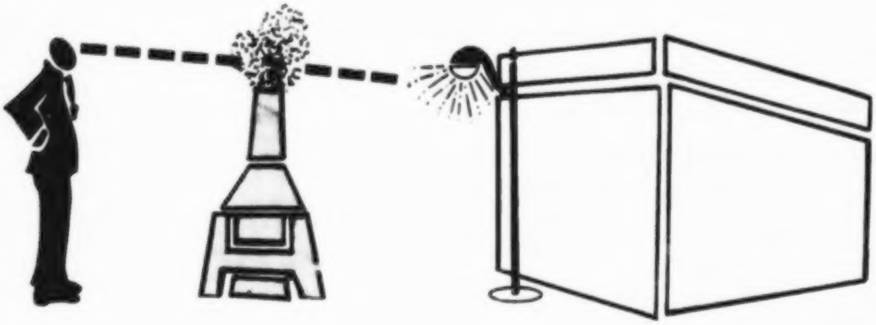


Figure 4-4. During darkness, the light source should emanate from behind the plume, opposite the observer (transmitted light).

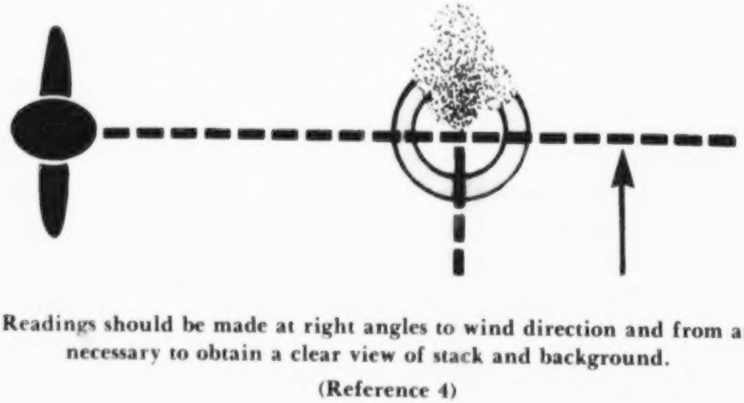


Figure 4-5. Readings should be made at right angles to wind direction and from any distance necessary to obtain a clear view of stack and background.

(Reference 4)

b. Observation times may be noted in terms of minutes and quarter-minutes, but not in terms of seconds except in extraordinary circumstances.

c. Record all emissions during observation, showing consecutive changes in readings.

d. Color of visible emissions should be recorded as seen and as it changes.

e. It is advisable to record all or a significant portion of the periods of excessive smoke observed during the inspection.

f. A violation notice cannot be issued unless the source emitted excessive smoke for more than the legally specified time limit in any one hour.

g. Any one hour means any period of 60 consecutive minutes.

h. Photographs should be taken before or after, but not during visual determinations.

L. Smoke from Moving Sources

1. Smoke from tailpipes and exhausts of vehicles is generally read in the same way that it is read from stationary source. The observer following or pursuing vehicle, however, should avoid reading directly into the plume, if possible. The line of observation should intersect the smoke trail at as wide an angle as possible. Error of reading smoke in this fashion should be compensated for.
2. Smoke should be read at its point of maximum density.
3. A stopwatch should be used to record accumulated violation time.

Documentation of a Violation

A. Collecting Evidence

Much of the time spent by field enforcement personnel will be in the collection and reporting of data and evidence. In fact, most of the data collected by such personnel are of an evidentiary nature. Whether such data are used in an emission inventory or in the prosecution of a violation, they will consist for the most part of facts and findings acquired through direct observation. They should be stated in such a manner as to be clear, concise and free of prejudices and other subjective factors.

B. Establishing the Prima Facie Case

To provide sufficient basis for court prosecution in a criminal case (such as where misdemeanor penalties are to be invoked) each and all the elements of the crime (in legal terminology, the *corpus delicti*) must be proved. To do so, the enforcement office or other principal witnesses must gather the evidence for a prima facie case, i.e., a case which on the face of it shows guilt and which, unless rebutted, adds up to the commission of a violation of a rule or regulation. In a criminal court case, the burden of proof of rebuttal is placed on the defendant after presentation of such evidence by the plaintiff (usually the people of the state).

Thus, if the rule alleged to have been violated is the prohibition that "a person shall not discharge into the atmosphere from any single source...any air contaminant" of any particular quality or quantity for more than the maximum permissible time specified, it must be proved that: (1) a person, (2) discharged, (3) into the atmosphere, (4) from a single source, (5) a contaminant, (6) of the quality prescribed (opacity or density), (7) for more than the time specified.

If any single element is missing (for example, it was not a single source), the *corpus delicti* is not established and there is no case.

C. Documentation of Evidence

1. *General*

The evidence required in court in order to establish a violation should be documented in carefully prepared reports. The information most commonly required is as follows:

- The nature and extent of the violation.
- The time and location of the violation.
- The person(s) responsible for the violation.
- The equipment involved with the violation.
- The operational, design or maintenance factors which caused the violation.

2. *For a Visible Emission Violation*

The specific evidence documented during a visible emission observation is as follows:

- Name of the source and location given as a street address or exact location with respect to fixed points, such as an intersection.
- The beginning and ending time of the observation period.
- The degree of opacity recorded for each 15 second period.
- Orientation of the observer, the sun and emission point. (Explain if circumstances do not permit the required sun orientation at the rear of observer.
- Estimate of distance, observer to emission point. Note that line of sight was clear. Otherwise explain.
- Approximate wind direction and estimate of wind speed.
- Temperature and humidity, especially if a wet plume is involved.
- Description of sky, if sky is background, color and presence of clouds, especially if plume is white or grey.
- Background with color if other than sky.
- Color of the emission.
- Name and title of observer.

Important: If the physical conditions prevent making the observation according to the specifications, especially with respect to sun orientation, notes should be made to justify the accuracy of the reading and perhaps marginal opacities should not be included in the time summary.

Note: Most agencies have a form for recording an opacity reading which includes identified spaces for the necessary information.

A sketch should be made of observation point and the area, including buildings and other structures pertinent to the observation.

D. Types of Evidence

The types of evidence used in court cases or administrative hearings include: (1) testimonial evidence, that is, direct testimony by witnesses, (2) demonstrative evidence, or physical evidence used to support the testimonial evidence, and (3) evidence presented by expert witnesses.

The enforcement officer will be most concerned with the presentation of testimonial evidence as to observations made directly by him. Typical examples would include observations made on visible emissions, on odors, on presence or status of construction, on items of equipment, on process or operational conditions and on conditions under which he secured certain samples, such as fuel oil. He will often testify as to statements made directly to him by operators of equipment and plant owners, or by complainants. He may also testify on such external factors as atmospheric and weather conditions, including temperature, relative humidity, sky condition, visibility, lighting, and wind speed and direction. In some cases he will be called upon to interpret demonstrative evidence such as photographs. Testimonial evidence will also often be given by laboratory personnel reporting on pertinent tests that they have conducted.

Demonstrative evidence is almost any physical evidence used to support direct testimony. It may include damaged property or vegetation, samples of fuel or process materials, records of analyses and photographs. In many cases, this type of evidence needs description or interpretation by an expert.

Damaged materials or vegetation samples may often be brought directly into a courtroom, provided the specimen is small enough to be transported or the damage pattern is not altered or disturbed. In some cases, test specimens may be placed in a preplanned pattern around the suspected source and retrieved for laboratory examination after a suitable time for exposure. The specimens could include test fabrics of differing materials and dyestuff, metal plates and greased glass slides or plates. In some cases, the damage pattern may be apparent to even the casual observer such as a gross deposit of a material readily identified by eye. Most often, however, testimony of an expert witness will be required. In some cases, supplementary evidence such as photomicrographs and laboratory analyses will be necessary.

Test data may include reports of source analyses, ambient sampling conducted in the vicinity of a source and on materials charged to the process in question. Source tests may range from rather simple tests for solid particulates at the process discharge to complex multi-point sampling for a variety of particulates.

gaseous contaminants and ancillary data such as flue gas composition, temperature and moisture content. Environmental sampling data collected in the vicinity of a source may include reports of analyses from manually operated sampling devices or recorder charts from continuous analyzers. Recorder chart data which can be correlated with the time of complaints and with meteorological data, such as wind speed and direction and atmospheric stability, can be very useful. Analyses conducted on process materials or fuels might include sulfur and ash content of fuels, metal charge composition, particle size distributions, and composition of incinerator feed.

Photographic evidence is usually used to give a graphic illustration of descriptions presented in direct testimony. Examples might include still or motion pictures of visible stack effluents; photographs showing the construction status of equipment, illustrating the condition of control equipment, or showing the effectiveness of fume hood pickup; pictures of damaged materials, and photomicrographs of finely divided particulate matter.

The FEO as an Expert Witness

The evidence of an opacity violation is the direct testimony, stating the facts, gathered by an "expert" trained in reading opacity. Therefore, the FEO must be qualified as an expert witness. The usual way to reach expert status is to become certified by attending "smoke school" and qualifying by a series of opacity reading, both black and white, and comparing the accuracy of the observer with a calibrated transmissometer. Certification requires a specified degree of accuracy. EPA Method 9-Visual Determination of Opacity of Emissions from Stationary Sources describes the method of qualifying and required accuracy for certification of smoke observers. Chapter 9 of this manual will give instruction on testimony as an expert witness.

Guidelines for Evaluating Visible Emissions in the Field

A. Introduction

This chapter outlines the steps to be followed to satisfactorily evaluate visible emissions in the field. Recommended guidelines are included for the collection of all information that is necessary to document a violation of the opacity regulation and for use in any subsequent legal proceedings.

B. Office Preparation

In most instances the inspector will have sufficient notice before making a field observation to adequately prepare for the visit. Preparation is a very important aspect of the inspector's work. The following items concerning the facility in question should be researched.

a. Plant location
b. Names and positions of responsible plant contacts (company officers or management personnel)
c. Type and number of processes
d. Type of process to be observed
e. Process operating conditions
f. Type and location of control equipment
g. Probable location of source emissions
h. Possible observation sites
i. Regulations applicable to the source
j. Status of source with respect to any variance or exemption from the agency's rules and regulations. Observation is not required if the source is on a variance, or exempt from the regulations.
k. Involvement of steam plume, if any. The procedure in the "Condensed Water Vapor Plume" section will indicate a time of day when a steam plume might not be present.

Familiarity with the opacity regulations, and the regulation exemptions will help to prevent an inspector from documenting what he perceives to be a violation when in actuality it is not. For example, although Colorado regulations state that an opacity greater than 20% constitutes a violation, a source may emit visible emissions of 40% opacity for 3 minutes out of 60 minutes if it is undergoing process modification, start up, cleaning, etc.

The recommended procedure is to determine a violation regardless of plant operation (e.g., for Colorado, an emission greater than 20% for any time period greater than 3 minutes would constitute a violation). In this way the investigator knows that a documented and enforceable violation has occurred without having to fear a company reporting at a later date than the readings (in the case of Colorado, greater than 20%, but less than 40% opacity) cannot be utilized because the plant was undergoing a process change at the time of the visible emission evaluation.

C. Field Equipment

The following equipment should be available for use by the observer:

a. Hard hat
b. Stopwatch
c. Clipboard, note pad and at least two pens (pencils must not be used for recording opacity readings).
d. Geologist's compass
e. Air velocity meter
f. Range finder
g. Psychrometer
h. Binoculars

i. Camera

j. Topographic maps

k. Necessary forms, including ample spare copies:
   1. Observation form
   2. Summary form
   3. Sketch form and data sheet, if standard formats are used.

l. Safety goggles

m. Safety shoes

n. Respirator face mask

o. Pouch, to carry the equipment

Note: Items l, m and n are required only if site conditions warrant their use.

The equipment should be inspected in the office before going out on a field observation in order to ensure that it is in good working order.

D. Observer's Location

Guidelines

The evaluator should select an observation point consistent with the following guidelines:

1. The line of sight from the source to the observer should be unobstructed.
2. The line of sight should be at right angles to the wind direction.
3. The sun should be oriented within a 140° sector to the observer's back.
4. The location should be safe.
5. If the pollutants are emitted at ground level, the observer should be as close to the source as possible.
6. If the pollutants are emitted from an elevated position, the inspector should be at a suitable distance from the source.
7. With good visibility it is suggested that the observer should be within about a quarter of a mile from the source.
8. When visibility is restricted, the observer should be within a distance that is about one quarter of the visual range.
9. When evaluating emissions from rectangular outlets, the observer should be positioned at right angles to the longer axis of the outlet.

Observation Site—Off Company Property

If a position can be selected that is not on company property, that meets all the above requirements, the evaluator may begin the field evaluation of the source in accordance with Evaluation Procedures (pg. 4-18). The inspector should not notify company officials that an evaluation is to be conducted

Observation Site—On Company Property

If the evaluator decides that it is not possible to select a suitable point that is not on company property from which to make the evaluation, then the evaluation should be carried out from a location on company property.

If a site can be selected that is on company property, but is accessible to the public, the evaluator may begin the evaluation without notifying company officials.

If, however, a site is on company property, that is not publicly accessible, then the evaluator must obtain permission from a responsible company official to enter the plant. Before notifying the company of the proposed evaluation, however, it is recommended that the inspector take several opacity readings from the best available site off company property. These preliminary readings can then be used as a comparison between stack emissions before and after company notification. If a noticeable change is observed, the inspector should record this fact.

If it is necessary to enter the plant property in order to make the observations, every attempt should be made to ensure management cooperation. Entering a plant, especially for the first time, can present a delicate situation; tact and courtesy should follow the steps below to correctly and courteously enter the plant for the purpose of conducting the evaluation.

a. When entering the plant be prepared to state your name, affiliation and position, and have identification available for presentation.

b. State the nature of your visit and request an interview with a company officer or responsible employee of the company.

c. Describe to the company representative the nature of work or duties you intend to perform on the premises and request their permission to do so.

d. Should you meet with refusal, and if attempts to discuss the situation are unsuccessful, contact your office for further instructions.

e. Should you be given permission to proceed to a specific area without escort, ask for directions and go there directly.

f. Spend as little time as possible with entrance procedures so as not to become liable to charges of "interfering with company work."

g. Do not sign any documents, such as liability waivers or others, that are conditions for your presence on the company premises. Discussion between your responsible officer and the plant official are the best means of resolving any problems that might arise in this manner.

h. Maintain a business-like and cordial relationship with company officials and employees at all times.

i. The evaluator should take note of the length of time he is kept waiting, cooperation and attitude of plant personnel, and any changes in operating conditions which may result from his presence. The latter may affect the credibility of the evaluator's findings should he later be asked about these conditions during the presentation of testimony.

j. Record the name, title and telephone number of the company official and note the time that the official was informed that an evaluation was to be conducted.

The inspector's ultimate objective is the improvement of the ambient air quality by ensuring that sources emit pollutants in compliance with the regulations. This objective can be achieved much more readily with the willing cooperation of the company. The visible emissions evaluation affords the inspector an opportunity to engage in some "public relations" work. The inspector should therefore endeavor to maintain a polite yet professional attitude while he is on company premises.

E. Evaluation Procedures

Observation Forms

Once a suitable observation site has been selected the inspector should begin the evaluation of the source, recording all the pertinent information on an approved set of forms.

Two sets of forms are included in the manual:

1. Those forms that appeared in the *Federal Register*, Volume 39, No. 219, dated Tuesday, November 12, 1974, and included as Figures 4-6 and 4-7.
2. Suggested alternative forms, included as Figures 4-8 and 4-9.

The forms in the *Federal Register* represent the approved forms to be used when making a visual determination of opacity at the time this manual was written. Although Method 9, the reference method for visual determination of the opacity of emissions, has been finalized, EPA is still considering additional changes to the observation time, and the method of evaluating exception periods and non-consecutive violations. The forms included as Figures 4-8 and 4-9 have been proposed as possible improvements to the *Federal Register* forms.

The forms that appear in any subsequent issues of the *Federal Register* should be used for recording the field data.

Types of Opacity Regulations

At the present time there are two types of opacity regulations in use. These are based on the following concepts:

a. Opacity is to be averaged over a specified time period—six minutes in the current Method 9 procedures—and this average opacity is compared to the regulation limit.
b. There is no need to average the observed opacities—any observed opacity that is greater than the regulation limit constitutes a violation.

Usually the opacity regulation will permit the source to emit visible emissions greater than the regulation limit for a specified time interval—often this exemption period is three minutes in a one hour period.

Figures 4-6 and 4-7 are used if the "average opacity" concept is employed.

Figures 4-8 and 4-9 are used if the "time" concept is employed.

OBSERVATION RECORD **Page** _______ **of** _______

Company ____________________ **Observer** ____________________
Location ____________________ **Type facility** ____________________
Test number ____________________ **Point of emissions** ____________________
Date ____________________

Hr.	Min.	Seconds				Steam Plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	0							
	01							
	02							
	03							
	04							
	05							
	06							
	07							
	08							
	09							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

OBSERVATION RECORD **Page** _______ **of** _______
(continued)

Company ____________________ **Observer** ____________________
Location ____________________ **Type facility** ____________________
Test number ____________________ **Point of emissions** ____________________
Date ____________________

Hr.	Min.	Seconds				Steam Plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	30							
	31							
	32							
	33							
	34							
	35							
	36							
	37							
	38							
	39							
	40							
	41							
	42							
	43							
	44							
	45							
	46							
	47							
	48							
	49							
	50							
	51							
	52							
	53							
	54							
	55							
	56							
	57							
	58							
	59							

(FR Doc. 74—26150 filed 11-11-74; 8:45 a.m.)

Figure 4-6. Observation record form.

RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE ____ of ____

Company ____
Location ____
Test number ____
Date ____
Type facility ____
Control device ____

Hours of observation ____
Observer ____
Observer certificate date ____
Observer affiliation ____
Point of emissions ____
Height of discharge point ____

	Initial			Final
Clock time				
Observer location				
Distance to discharge				
Direction from discharge				
Height of observation point				
Background description				
Weather conditions				
Wind direction				
Wind speed				
Ambient temperature				
Sky conditions (clear, overcast, % clouds, etc.)				
Plume description				
Color				
Distance visible				
Other information				

Summary of Average Opacity

Set Number	Time	Opacity	
	Start—End	Sum	Average

Readings ranged from ____ to ____% opacity

The source was/was not in compliance with ____
at the time evaluation was made.

Figure 4-7. Record of visual determination.

VISIBLE EMISSION OBSERVATION FORM

Source name ______________________ **Observer** ______________________

Address ______________________ **Date** ______________________

Observation point: ______________________

Stack: distance from ______ height ______

Wind: speed ______ direction ______

Sky condition: ______________________

Color of emission ______________________

Ambient temp: dry bulb ______°F

wet bulb ______°F

Relative humidity: ______________

Observation began ______ ended ______

Observer's signature: ______________________

Certification date: ______________________

Comments: ______________________

	0	15	30	45		0	15	30	45
0					30				
1					31				
2					32				
3					33				
4					34				
5					35				
6					36				
7					37				
8					38				
9					39				
10					40				
11					41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

Figure 4-8. Visible emission observation form.

RECORD OF VISUAL DETERMINATION OF OPACITY

Page____ of____

Company ________________
Location________________
Test number ________________
Date ________________
Type facility ________________
Control device ________________

Hours of observation ________________
Observer________________
Observer certification date ________________
Observer affiliation ________________
Point of emissions________________
Height of discharge point ________________

NOTE: Record the following information prior to, and upon completion of, observations at each source. If observations are made over an extended period of time, additional recordings should be made, as applicable.

	Initial			Final
Clock time				
Observer location:				
Distance to discharge (ft.)				
Direction from discharge				
Height of observation point (ft.)				
Meteorological conditions:				
Ambient temp (°F) dry bulb/wet bulb				
Relative humidity %				
Wind direction				
Wind speed (mph)				
Sky conditions:				
% Cloud cover				
Plume description:				
Color				
Distance visible (ft.)				
Other data				

Summary of Readings

Opacity	0-20	21-30	31-40	41-60	61-80	81-100	Total
No. of readings							
Frequency %							

Readings over ________%. Average opacity = ________%
Readings ranged fron ________ to ________ opacity.
Opacity exceeded ________% for ________ mins ________secs.

Regulation:

Figure 4-9. Record of visual determination of opacity.

Observational Data

The inspector should begin the evaluation by recording the source identification parameters, site location and ambient weather conditions on the observation forms, Figures 4-6 and 4-7 or Figures 4-8 and 4-9.

A photograph of the source should be taken at this point.

Procedures for Reading Steam Plumes

This section describes procedures for reading steam plumes.

Attached Steam Plumes

When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations should be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer should record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

Detached Steam Plumes

When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

Recording Presence of Steam Plumes

If the forms in the November 12, 1974 *Federal Register*, Figures 4-6 and 4-7 are used, a check mark should be placed in the approximate box to denote the presence of a steam plume.

If the suggested alternative forms, Figures 4-8 and 4-9 are used, a note indicating the presence of an attached or detached steam plume should be made in the "Comments" section.

Recording Observations

Observations should be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer should not look continuously at the plume, since this can lead to eye fatigue, but instead should observe and evaluate the plume momentarily at 15-second intervals.

Number of Readings

In order to meet the requirements of EPA Method 9, the required number of readings is as follows:

1. In all cases, a minimum of 24 readings must be taken corresponding to six minutes of observation.
2. In cases where the regulation permits an exemption period for excess emissions, a minimum of 24 observations must be recorded over and above the number of readings equal to the permissible exemption period. For example,

if the regulation permits 3 minutes of excess emissions in any hour, a minimum of 12 readings (3 minutes) plus 24 readings (6 minutes) must be recorded. That is, a total of 36 readings (9 minutes) must be recorded in order to establish a single six-minute average for that hour.

While it is a simple matter to establish the minimum number of readings necessary to meet the requirements of Method 9, it is not a simple matter to establish the number of readings necessary to document an enforceable violation of the opacity regulations. Whether there is sufficient proof that a violation did occur will depend upon the amount of evidence collected in the field. The more readings above the regulation limit that are observed, the stronger will be the ensuing case if the results of the evaluation are used as evidence at any subsequent legal proceedings.

Some guidelines to aid in this matter are given below:

Guideline 1:

In most cases, the amount of evidence that should be regarded as the minimum necessary to document an enforceable violation should consist of at least one set of 24 readings with an average opacity of at least 10% above the regulation limit.

Guideline 2:

Concerning regulations based on actual opacity instead of average opacity, it is recommended that before legal proceedings are initiated, the observed opacity should exceed the regulation limit by at least 10% for at least three minutes in any hour; this is in addition to any exemption time period that may be permitted for excess emissions.

Guideline 3:

Weather conditions during the observation period should be taken into account when considering the number of observations and the degrees of excess emissions necessary to document a violation. Tests conducted by EPA indicate that the possibility of a positive bias is greatest when a contrasting background is used (i.e.—white plume, blue sky). In a similar manner when a noncontrasting background is used (i.e.—white plume, overcast sky) the possibility of a negative bias is greatest. In fact, the test results indicate that the chance for positive error in determining the opacity of white plumes is essentially nonexistent when a noncontrasting background is present. This should be taken into consideration when the inspector is determining the amount of data needed to verify a violation.

Guideline 4:

The actual opacity of emissions from the source can be used as a further guideline in determining the number of readings that are necessary, e.g., if the opacity of the emissions is 100% an observation time of six minutes in excess of the exemption period should be sufficient evidence to ensure that the violation could be enforced. If, however, the opacity of the emissions average about 30%, in those areas where the regulation limit is 20%, considerably more readings would be necessary.

Sketch

A reasonably detailed sketch should be drawn. It should include sufficient detail to allow a person who has not visited the site to determine the source that was evaluated and the location of the observation point. The sketch should depict.

Source location
Observer location
Distance from observer to source
North direction
Wind direction – from which wind is blowing
Sun position
Landmarks and nearby streets
Plume type
Distance plume visible

An example of a sketch is shown in Figure 4-10.

Photographs

Photographs should not be taken during the observation period. They should be taken before and after the observation is made. Even though photographs cannot be used as evidence in court, they do put on permanent record conditions as they existed at the time of the observation. The use of a 35mm camera is recommended, so that good photographs are ensured.

Each photograph should be identified – including such information as date and time the photograph was taken, the source and the position from which the photograph was taken.

Number of Observers

Only one inspector should evaluate a given source during any given period of time. In cases where the source is continually evaluated and reevaluated over extended periods of time (days and months), it is acceptable, indeed preferable, to have different inspectors perform the evaluations.

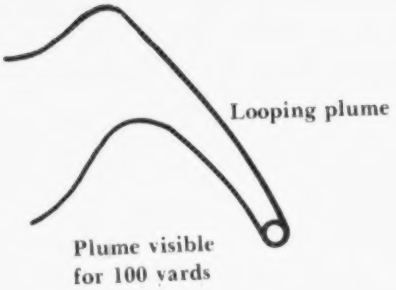
Data Reduction—"Average Opacity" Concept

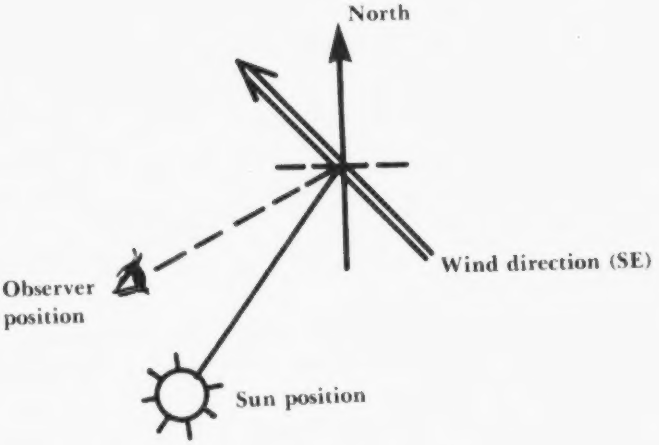
Opacity is determined as an average of all the readings taken over a time period corresponding to the applicable standard. For example, for a six-minute standard, the opacity is defined as the average of a "set" of any 24 consecutive readings taken over a six minute period at 15 second intervals. The observations recorded on the observation record sheet, Figure 4-6 are divided up into sets of 24 consecutive readings and the average opacity for that set is determined by dividing the sum of the readings by 24.

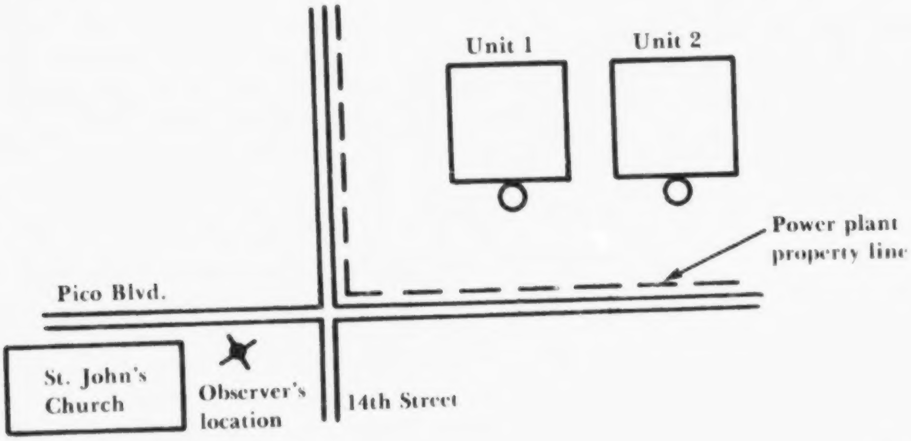
The sum and average opacity for each set is entered in the "Summary of Average Opacity" table in Figure 4-7. The sets need not be consecutive in time, but in no case should two sets overlap.

Field Sketch

Date: November 1, 1974
Time: 1400-1500
Observer: Robert Missen
Source: CGE Power Plant
Unit 1, Santa Monica, CA


Looping plume
Plume visible
for 100 yards


North
Wind direction (SE)
Observer
position
Sun position


Unit 1
Unit 2
Power plant
property line
Pico Blvd.
St. John's
Church
Observer's
location
14th Street

Comments: No steam plume visible

Observation made from St. John's Church parking lot.

Figure 4-10. Field sketch.

Data Reduction—"Time" Concept

The opacity readings recorded on Figure 4-8 should be summarized by completing the items on the right hand side of Figure 4-9.

F. Source Inspection

After the visual observation has been made, whether from a location inside or outside the plant operation, an inspection of the source that was evaluated, should be made. To do this, the highest ranking official of the company, who is readily available, should be contacted.

At all times during the inspection the inspector should maintain a business-like relationship with company personnel. If requested by the company representative, the inspector may give a brief discussion of the purposes of the opacity evaluation.

The inspector should not under any circumstances indicate whether a violation of the regulations was observed, and indeed at the time of the inspection a determination of whether a violation was observed will not have been made, since the information on Figures 4-8 or 4-9 has to be completed before such a determination can be made.

During the inspection, information concerning the source should be obtained from the company official. This information can be obtained by asking such questions as:

1. Were the plant and the source of interest operating normally at the time the evaluation was conducted?
2. Are there any control devices associated with the source? Were they operating properly?
3. When were the source and its control device installed or modified?

Since an inspection report has to be written after the evaluation has been made, the relevant information about the source should be collected and recorded in a standard format. A data sheet similar to Figure 4-14 should be used to record this information.

Visible Emissions Evaluation Data Sheet

Observer: ______________________________

Date: ______________________________

Company data

Company name: ______________________________

Company address: ______________________________

____

Company contact: ______________ Telephone: ______________

Source data

Source identification: ______________________________

Applicable regulation: ______________________________

Operating rate: ______________________________

Normal operating rate: ______________________________

Construction/modification date: ______________________________

____

Control system data

Type: ______________________________

Design efficiency: ______________________________

Installation date: ______________________________

____

Comments: ______________________________

____

____

____

Figure 4-11. Inspection data sheet.

Chapter 5

Onsite Inspection of Sources

ONSITE INSPECTION OF SOURCES

Goal

To teach good inspection methodology for inspection of the source premises, decision making, actions to be taken and documentation of the result thereof.

Objectives

At the end of this lesson, the student should be able to:

1. State the definition of "on-site inspection."
2. Define the purposes for which inspections are made.
3. Differentiate between single and multi-purpose inspections.
4. Explain preentry preparation.
5. Explain the steps taken to gain entry.
6. Describe the situation wherein a warrant may be necessary.
7. Explain the proper procedure for conducting an interview.
8. List the main points of source ownership identity.
9. List the important points of inspection of the process or equipment.
10. Identify the information to be supplied to the source.
11. Write a notice of violation.
12. Identify at least five essential points of an effective report.
13. Identify the several ways of serving a notice of violation.

Selected Reading

Reference 4—APTD-1100—Chapter 2—IV, V, VI and VII. Chapter 4—IV, B 3, 4, 5.

Reference 9—Communication for Justice Administration, Chapters 4, 6 and 7.

ONSITE INSPECTION OF SOURCES

Introduction

The purpose of this chapter is to describe the principles of inspecting a source to develop facts needed to determine compliance or noncompliance with a rule or regulation. The method of obtaining information, making inspection of equipment, gathering data and the decision making process (compliance or noncompliance) is presented. The concluding actions and report writing are included.

Types of Inspections

An inspection of an air pollution emission source consists of entering a facility for the purpose of obtaining information or collecting evidence.

A variety of inspections are conducted to gather evidence in relation to: an observed offsite violation; followup of a previous inspection; a check on equipment for construction permit, a cyclic operating permit, compliance plan status, or obtaining source registration; complaint investigation; or providing owners and operators with information on legal requirements.

Many inspections are conducted for a single purpose, such as checking to see whether construction is continuing after a permit application has been denied. Other inspections are comprehensive; that is, they are conducted to inspect and gather information on all equipment and processes located within the facility.

The type of inspection relates to the reason for which the inspection is made. The terminology is assigned for ease of communication.

A. Facility Inspection

The facility inspection is a comprehensive inspection made of all the equipment and processes at one source premises. A source premises is one geographical location such as Plant 1 or "Works," and may include one or more structures, or operating areas. The emission points may be single or multiple, with multiple sources numbering in the hundreds for large industrial complexes as refineries, petro-chemical plants, steel mills, etc. A single complex source premises may be subdivided into areas, each of which becomes a facility. Example: The open hearth shop of a steel mill.

Facility inspections are sometimes referred to as "plant inspections," "source inspections," "annual inspections," "inventory inspections," and "scheduled inspections." While terminology and procedures may vary among control agencies, all inspections of this type are concerned with accounting for all possible sources of air pollution located at a facility and with assessing the compliance or noncompliance with the rules and regulations of all elements of the facility.

Under Facility Inspection will be included those limited purpose inspections which are programmed in advance, as

1. *Construction Permit Inspection*

The construction permit inspection is the site visit made periodically throughout the construction period or at completion of construction to see that the conditions of the issued permit are met. In complex facilities, construction permit inspections are often made by an agency air pollution engineer. In such cases, the FEO should arrange to visit the site with the air pollution engineer who granted the permit to construct some time during the final stages of construction, to become familiar with the source facility, especially the emission points, the potential emissions, control hardware and the instrumentation to monitor the emissions.

For a new or modified facility, initial operating permits are required separately or are included with the construction permit application. Prior to granting the initial certificate of operation, a source emission test is usually required at which the FEO, or the agency air pollution engineer, or both, are present in the role of observer.

2. *Cyclic Source Inspections*

The cyclic operating permits are required where the facility, following construction, is granted a time limited operating permit. Periodically, an inspection of the entire source premises or some designated facility within a complex is required to ascertain compliance and qualifying for operating permit renewal.

The Federal EPA enforcement program requires cyclic source inspections by federal inspectors in company of state or local FEOs or to be made independently. Present federal policy requires a federal inspection of 10 percent of the major sources within state or local jurisdiction.

3. *Compliance Plan Inspection*

The compliance plan inspection applies to those sources which are operating under an order that includes a schedule of milestones indicating progress to ultimate correction of a violation condition. See Chapter 3, page 3-5. Inspection is limited to the particular process and site visits are made to determine if the time schedule set down in the plan is being met.

B. Violation Inspection

A violation inspection is made to gather facts related to an observed violation, as a result of offsite surveillance program. The investigative process is usually limited to the process associated with the violation recorded. However, it is extended to other areas of the facility when other nonconforming conditions are uncovered.

C. Complaint Inspections

Site visits are made to investigate citizen complaints. Specific regulations may be involved if preentry observation shows violating conditions. Complaint handling is treated more completely in Chapter 11.

D. Inspections Relating to Emergencies

Emergencies are of two types: (1) local emergencies—incidents involving the untoward release of contaminants that may be toxic or have the potential for other undesirable health or environmental effects and (2) air pollution episodes in which the buildup of contaminants in the atmosphere approaches or exceeds predetermined alert stages and which may necessitate the curtailment or shutdown of source activities on a large scale. These conditions will require swift response on the part of enforcement officers and performance of special inspections.

Response to emergency and alert situations is covered in Chapter 15.

Elements of the Inspection Process

A. Preentry Observation

All programmed inspections (permit, cyclic, CPI, etc.) and complaint inspections begin with an observation of the exterior of the source premises. Inspection for observed violation will have been triggered by the event.

Chapter 4 deals with exterior surveillance and should be followed.

B. Preparation for Entry

1. *Programmed Inspections*

The FEO can prepare in advance for the site visit. There will usually be available a complete inspection form which, in addition to having business information entered, will have a stylized guide to the inspection process. For complex industries, there is a trend to computerizing emission inventories which could be readily extended to a preinspection document that can be carried into the field by the FEO. Permits for construction should highlight inspection points.

It is unreasonably poor practice to expect an FEO to conduct a complex source facility inspection without thoroughly preparing him in advance for the involved task, and providing him with the necessary inspection program in forms and related documents.

2. *Inspections Following an Observed Violation*

The preentry preparation is somewhat more difficult. Some FEOs will have business and emission data in files carried with them into the field. An extension of the inspector's source file is a set of records on microfiche with a portable reader in the FEO's vehicle.

If source data is not "on-board," the FEO should contact his office by two-way radio, if his vehicle is so equipped or by land phone if available, to obtain business data and especially names and titles of people to be contacted.

A brief assessment of the source manager's attitude and record of previous violation would be helpful.

Often the FEO, if he works within a district and the source is marginal with respect to compliance, will be thoroughly familiar with the source and contact people. This is particularly true in the smaller local agencies.

3. ***Responding to a Complaint***

The FEO can check the source files before leaving his headquarters, but if he receives the complaint by two-way radio he should expect a "fill-in" on the suspected source similar to the above.

4. ***Organize the Inspection Plan***

After developing all of the available preentry information, the FEO should organize and plan for his entry to the premises:

- The purpose for the inspection,
- Who he wishes to see with alternates, if known,
- What information he seeks,
- The order of the investigative process.

C. Entry to the Premises

The procedure described here is the usual procedure for an unfamiliar or poorly documented facility. Where the FEO is familiar with the source and certain of the correctness of his data, some of the steps may be omitted.

1. The usual procedure is to seek entry through the front gate or front door by
    - Identifying yourself and stating your business. Produce credentials when requested or show them in advance.
    - Ask for the facility manager by name, if known; by title, if not known.
    - Abide by company visitor rules. While you are an "official", you are not an employee and certain procedures may be specified to gain entry.
    - Most agencies advise or prohibit the FEO from signing any documents, such as waivers or others, that are conditions for your presence on the company premises. Discussion between your supervisor and plant official is the best means of resolving any problems that might arise in this matter.
2. When entry is denied, and it may be in an unusual case, the FEO may:
    - Immediately change his posture. Become "rough". Example: "Your position gives me no alternative but to proceed legally against your company and I will do it. Your attitude closes all other possible enforcement routes."
    - Advise of possible action for "failing to grant entry". Section 114 of Clean Air Act or appropriate local regulation.
    - Obtain a search warrant. (See Chapters 6 and 7.)

D. Management Interview

Entering a plant, especially for the first time, will require a longer interview with the manager or his representative than for repeat visits. Subsequent visits would be of shorter duration and the manager may be bypassed where an environmental contact is established by the FEO. The following are guidelines which should be helpful to the novice FEO in developing a businesslike style as he pursues his mission:

- When ushered into the manager's office, identify yourself. If you are introduced by a receptionist, listen to be sure you are properly identified and correct any errors.
- State your business in concise terms such as: "I wish to inspect the construction site for the bag house, Permit No. A65." or, "I have observed a 12-minute visible emission effluent from the boiler house stack and wish to investigate the cause."
- Avoid excessive small talk. A simple but cordial "good-morning" is preferable to discussing the weather or last Sunday's football game.
- Don't be excessively accusing or berating. (No matter how mad or aggravated you are at this particular source.)
- Conserve time – your time and the manager's time.
- Know what information you want from management and where you want to go after management interview.
- Give manager time to respond and listen. What he says is important to recall. You learn nothing if you do all the talking.
- Make notes as interview progresses. If you use a recording device, be sure to reveal same and secure permission to record other voices.
- If you wish to take photographs, secure permission, explaining the reason for the photographs. If denied, forget about photographs and take complete notes. Perhaps sketches, if they will aid and you have this ability.

1. The interview in the manager's office establishes the business data and what you wish to do.
    - The present legal owner.
    - The type of business: subsidiary, partnership, individually owned, etc.
    - If a corporation, the corporate identity.
    - Correct addresses of source, and corporation headquarters, division headquarters, etc.
    - The nature of the business.
    - Full name and title of the responsible facility manager. Make sure you will be able to identify this person at a future time, if necessary.
    - Full name and title of person to conduct you to the site of interest.
    - The documents or plant records you wish to inspect, especially production rates and materials involved.
    - The inspection plan you wish to follow.

    Caution: If the FEO already has some of this information, be sure to verify same since ownership and management change.

E. Process and Equipment Inspection

The complexity of the facility and type of inspection being made determine the time required. This part of inspection is often made with a source facility staff environmental engineer who may or may not be familiar with the investigative methods of the FEO. Where it is uncomplicated as in a small industrial boiler house, the FEO may be on his own.

1. Process or Equipment Inspection

   During process inspection the FEO will:

   - Obtain or confirm operational responsibility with names, titles, etc.
   - Check process and equipment involved, identifying same by name, number or location.
   - Review equipment operating schedules or logs.
   - Inspect control equipment and determine specific abatement measures.
   - Status of compliance with permit regulations
     Is permit posted?
     Is operating permit outdated?
   - Inspect Instrumental Process Data – recorded or indicating.
   - Inspect continuous emission monitor data.
   - Be observant for signs of poor operating practice or maintenance.

F. Operator Interview

Only for violation or perhaps complaint inspection is it necessary to interview the operator. If there is no operator in attendance, ask to interview the process supervisor or other responsible person who has personel knowledge of the process operation. Be sure full names and titles are obtained and recorded.

Where an operator is in attendance:

- Obtain his complete identity.
- Does he normally operate?
- Was he operating or in charge when the event occurred?
- Was there a deviation from normal operating procedures?
- If so, why?
- Who instructed him to deviate?
- Note – all this while you are seeking to place responsibility.
- Who supervises the operator?

G. Drawing Conclusions

After completing the inspection, it now becomes the FEO's responsibility to form a judgment whether the source, equipment or process is in compliance or non-compliance status. Some agencies do not specifically require this, but unless the

FEO practices this process and forms solid convictions on his own, his whole inspection effort can be weak and inconclusive. In certain cases, he may be able to exercise this judgment only after consulting with his superiors, the engineers or obtaining the results of source tests. In the final analysis, he must know the "bottom-line," compliance or violation.

1. ***Noncompliance***

   Where noncompliance is the decision, the FEO should develop the following:
   - The specific permit condition in noncompliance.
   - The specific rule or regulation, by section number, which was violated.
   - Is the violation continuing?
   - The reason for noncompliance. While not germane to establishing the existence of a violation, it is important to the investigation and the successful prosecution of the case, should court action result.
   - Are there unauthorized process modifications (compared to valid permits)?

2. ***Breakdown***

   The cause of noncompliance is frequently blamed on breakdown, temporary upset or bad materials. Where emergency conditions are given as a cause, the FEO must determine:
   - Was there, in fact, a breakdown or emergency? Do not just accept the word of the plant personnel. Probe the event. Look for signs to verify the allegations. Look for spilled product, evidence of temporary repairs or other irregularities. Check logs or recording instruments for upset conditions.
   - Do the rules provide exception? Know what the regulations provide and check the plant record.
   - Does the breakdown result from poor maintenance?
   - Are the breakdowns frequent, indicating poorly maintained or worn out equipment?
   - Was prompt, aggressive, and effective action taken to correct the condition or minimize the emission during the upset period?
   - Does the company have a plan to prevent recurrence?

H. Providing Information

Jurisdictions vary widely in their policy of having the FEO provide directly to the facility management, at the conclusion of an inspection, a statement of the conditions found, i.e., compliance or noncompliance. The Federal EPA instructs field officers to say as little as possible about the results of the inspection and in no case state a condition of violation or compliance was observed. Many local and some state agencies require FEOs to serve a notice of violation before leaving. The majority follow the inbetween practice of having the FEO advise verbally of findings and follow with a written notice after review of the FEO report.

Giving Notice of Violation

For those agencies which issue a notice of violation at the inspection site, the key elements are:

- Identification of the violator, the name and address of the company and the mailing address, if different.
- Source ownership, whether it is a corporation or private ownership (partnership or individual).
- If a governmental entity, so state.
- The name and title of the person in charge of the facility during the time of the violation.
- The date, time, location of the violation, and any other data necessary as may be required by the special circumstance of the violation.
- The name and position title of any other plant personnel (such as operator) who may share responsibility for the violation.
- Identify the statute violated by number.
- The person to whom the notice is served along with his position in the company.

Preparation of the Report

Most agencies provide report forms or inspection forms convenient for recording all the necessary data and providing ample space for comments. In addition to filling in the blanks, a narrative summary is nearly always required.

Immediately upon return to your car look over the data to see that you have written down all the pertinent data. It is easier to go back immediately to verify questionable notes or missing information than to try to complete your report by phone or revisit the source at a later date. In such cases, be sure not to show harassment of "lack of knowledge" or sloppy work.

Develop skill in report writing by

- Being objective.
- Include only what is important. (Aided by good note taking during interview.)
- Remember, you may need this report at some date in the future to recall events for preparation of verbal testimony.
- Do not include unnecessary information which may damage your case, especially when you are uncertain about such material or such material is subjective or based on personal bias.

Eleven Check Points

Knight and Stevenson (Reference 9) give the following eleven check points for a clear and accurate report which favorably represents the writer's organization:

1. Provide accurate labels for each of the persons, places and things mentioned in your report.

2. Use accurate time citations, providing a realistic time range where exact time is not known.
3. Try to keep your account of events within chronological order.
4. Don't use jargon.
5. Be careful to use appropriate quotation format.
6. Watch out for misleading pronouns.
7. Explain each occurrence within your report, no matter how obvious it may seem to you.
8. Remain in the third person, describing the actions of "reporting officer" rather than telling what "I" did.
9. Avoid all personal assumptions, and the unverified conclusions which proceed from them.
10. Describe rather than label; let readers draw their own conclusions.
11. Include careful accounting of all required and proper "field" enforcement procedures.

Conclusion

The first five units of the Student Manual deal with the FEO's job, his responsibilities and how he carries out his mission in the field. His mission, simply stated, is to bring into continuing compliance with the rules and regulations, all of the sources assigned to him.

The FEO alone is not responsible for seeing that the AAQ standards are met; this is the team effort of the entire agency, the planners, the technicians, the engineers, and the director.

Most agencies hold that compliance by voluntary effort from the source, prodded and perhaps goaded by the FEO, is the quickest and most inexpensive means of getting results. However, most agencies are not so naive to hold that all sources will comply by voluntary effort. They will all let the "nightstick of authority" show just a little during negotiations and let their resolve be known to litigate for compliance, if the voluntary effort fails.

In all of his field work, he should be mindful of the possibility that in the future he may be called upon to verbally testify that which he perceived to be evidential proof of noncompliance. His records and his ability to recall and communicate will be a key in the success of the legal enforcement route.

Chapter 6

Basic Federal Legal Provisions U.S. Constitution and the Clean Air Act

BASIC FEDERAL PROVISIONS U.S. CONSTITUTION AND THE CLEAN AIR ACT

Goal

To teach the Federal legal provisions applicable to Air Pollution Control law and enforcement: (a) The principles of the Fourth, Fifth, and Fourteenth Amendments of the U.S. Constitution and (b) Introduce the principles of the Clean Air Act as amended.

Note: An overview of the Federal Enforcement Program will be given in Chapter 10.

Objectives

At the end of this lesson, the student should be able to:

1. Identify the Fourth Amendment as providing protection from unlawful search and seizure, and the limitations for gaining entry to a source premises.
2. Define right of entry and when a search warrant may be necessary.
3. Identify the Fifth Amendment as providing protection against self-incrimination, except for corporations.
4. Identify the Fourteenth Amendment as establishing the principles of "due process" and "equal protection".
5. Define the responsibility for enforcement of the Federal EPA, states and local governments as applied to (a) all sources except mobile, (b) mobile sources, (c) emergencies.
6. Identify the preconstruction control under the requirements of new source review for NSPS, NESHAPS and PSD.
7. State the responsiblity of the Federal EPA when states fail to enforce their SIPS (Section 113).

BASIC FEDERAL LEGAL PROVISIONS—THE U.S. CONSTITUTION AND THE CLEAN AIR ACT

Introduction

This unit will be concerned with federal constitutional and statutory provisions which affect air pollution enforcement.

Constitutional Provisions

There are several amendments to the U.S. Constitution which need to be considered by field enforcement officers in the discharge of their duties.

A. The Fourth Amendment

This guarantees that citizens will be free from unreasonable searches and seizures. The search and seizure problem can arise in an air pollution context in that most air pollution control statutes have a provision allowing agency inspectors to enter a facility at reasonable hours for the purpose of investigating suspected pollution activities. Generally inspectors have not been required to obtain a search warrant prior to conducting an investigation. Such a warrantless search has generally been justified in view of the fact that air pollution laws are related to the protection of public health. However, even where a warrant is not required, the key to the propriety of such a search is "reasonableness." That is, the search has to be reasonably related to air pollution control purposes and a certain amount of propriety has to be exercised—i.e., conducted during reasonable hours with the investigators showing proper identification to the owner or plant manager of the facility to be inspected.

Very recently, a federal court has required inspectors for the Occupational Safety and Health Administration (OSHA) to obtain warrants prior to entering a plant property for inspection of OSHA regulations. To date, there has never been such a requirement placed on air pollution inspections. Since the effects of an air pollution violation are felt directly by the public, the public's right to an investigation of the source seems stronger than in a purely inplant situation.

In any event, the issue raised by administrative searches involves a weighing of an individual's right to privacy against the need of a city, state, or federal program to protect citizens from hazards to their health or welfare.

B. The Fifth Amendment

This guarantees that a person cannot be required to give testimony against himself. This arises in an air pollution context in that most air pollution control statutes have a provision requiring sources to supply self-reporting data and emissions inventories. Such data is extremely valuable in checking a source's compliance status. There are several reasons why the Fifth Amendment has not posed a deterrent to the use of self-reported data:

1. Fifth Amendment rights do not extend to corporations but only to individuals;

2. Most air pollution enforcement actions (at least at the state and federal levels) are civil actions rather than criminal prosecutions and courts have held that protection against self-incrimination applies only if a person is faced with criminal sanctions.

C. The Fourteenth Amendment

This guarantees due process of law and equal protection for all citizens. Due process principals demand that a statute enacted under the police power be applied by the enforcing agency in a reasonable manner and that the air pollution control standard bear a reasonable relation to the interest that the standard is supposed to protect (i.e., public health, the quality of air resources, etc.). One of the best ways to ensure due process is to provide an opportunity for public hearing prior to the adoption of regulations or prior to major agency action.

The equal protection clause of the Fourteenth Amendment forbids the enactment of laws that establish arbitrary systems of classification or that permit discrimination between persons of the same classification. Persons or subjects may be classified for legislative purposes if such classifications are reasonable and bear a rational relationship to the purpose of the regulation. For example, a hydrocarbon control regulation may be directed at storage tanks of a certain size, while excluding smaller tanks. This would not be unreasonable because the size of a storage tank is related to the amount of evaporative loss and is therefore a valid consideration in hydrocarbon regulation. However, a regulation would be arbitrary if it provided that any hydrocarbon storage tank with an ecology flag painted on the side would be exempt from regulation. Such a rule would not have any reasonable bearing on air pollution control.

The Federal Clean Air Act (FCAA)

The fundamental precept of the Clean Air Act of 1967, as amended in 1970 and in 1977, is that the major responsiblity for control of air pollution from stationary sources rests with state and local programs. Under the statutory framework of the Act, EPA does not enter the enforcement picture unless the state or local programs have failed to do the job prescribed in the Act. The control of air pollution from new *mobile* sources has been given directly to EPA. Thus, EPA sets the standards for new automobile engines, fuels or fuel additives, and aircraft emissions. The reason for this is obvious. If every state had a different standard for these types of mobile sources, there could be a substantial interference with interstate commerce.

A. State Implementation Plans (SIPs)

Under the Federal Clean Air Act the EPA is required, among other things, to establish national ambient air quality standards (NAAQS) for the major air pollutants. The 1970 amendments established dates for attaining the ambient standards. For most areas the attainment date for each pollutant was June 30, 1975. Congress realized that the standards were not attained in 1975 and amended the Clean Air Act to allow nonattainment areas to continue the process of bringing sources into compliance with the applicable plan or to modify the plan to achieve the standards. For nonattainment areas, Congress places restrictions on the growth of sources (in the form of the Offset Policy discussed in Section B.3) and required SIP revisions to be submitted which will demonstrate attainment on or before June 30, 1982. For mobile source related problem areas they must demonstrate attainment as expeditiously as practicable but no later than December 31, 1987. However, Congress required specific steps to be taken. Those areas which attained the standards prior to August 7, 1977, have to maintain those standards.

Section 110 of the Act required all states to submit an implementation plan laying out the details of how the NAAQS were to be attained and maintained by the statutory dates. These SIPs include emission limitations for stationary sources and control strategies. The SIPs form an enforceable commitment on the part of the states and the requirements of the SIPs can be enforced by EPA if the state and local programs fail to enforce.

B. Federal Enforcement

1. *Section 113 of the FCAA*

This section provides that whenever the EPA Administrator finds that a violation of a SIP requirement is occurring, he shall notify the person who is violating the plan and the state in which the plan applies. If such violation extends beyond the thirtieth day after notification, the Administrator may issue an order requiring the violator to comply with the requirements of the SIP or he may bring civil action in court for appropriate relief, including a permanent or temporary injunction, and/or a civil penalty or not more than $25,000 per day of violation.

2. *Section 303 of the FCAA*

This provides that when a pollution source is presenting "imminent and substantial endangerment to the health of persons", *and* the "appropriate state or local authorities have not acted to abate such sources," the Administrator may bring suit to immediately restrain the violation.

3. *National Emission Standards for Hazardous Air Pollutants (NESHAPS)*

Section 112 of the FCAA requires the Administrator of EPA to establish standards for air pollutants to which no ambient air quality standard is applicable and which in the judgment of the Administrator may cause, or contribute to "an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." A NESHAP standard applies to any new or modified source. In addition, existing sources are required to comply with a NESHAP standard within ninety days after its effective date.

C. Permit Requirements

Under the Clean Air Act of 1970, states were required to have, as part of a SIP, a permit system for preconstruction review of stationary sources. The 1970 Act dealt with permits in virtually a single paragraph setting out a very broad requirement that states have a program for preventing the construction or modification of any new source to which a standard of performance under Section III of the Act applied at any location which the state determined would prevent the attainment or maintenance of an NAAQS.

In contrast, the 1977 Amendments set out a great amount of detail as to what must be reviewed prior to the issuance of a permit. Basically, the following standards must be met:

1. ***New Source Performance Standards (NSPS)***

   Section III of the Act requires the Administrator to publish a list of categories of stationary sources which may contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. He must then propose regulations establishing standards of performance for new sources within each category. Enforcement of these standards can be delegated to the states.

2. ***Prevention of Significant Deterioration (PSD)***

   The concept of preserving those areas of the country with air quality cleaner than that prescribed by the NAAQS gained attention as the result of a suit brought by the Sierra Club against EPA (*Sierra Club V. Ruckleshaus*). A Federal Court of Appeals agreed with the Sierra Club's position and ordered EPA to revise all SIPs to prevent significant deterioration in clean air areas. The U.S. Supreme Court split four to four in its review of the case, thereby letting stand the Court of Appeals decision.

   However, even after the PSD concept became clearly established as a requirement of the Clean Air Act, there were many unanswered questions as to how this policy was to be implemented. The very definition of "significant deterioration" was far from clear. EPA attempted to shed light on the matter by proposing regulations outlining how PSD was to be implemented through state construction permit reviews. When Congress adopted amendments to the Clean Air Act in 1977 it largely incorporated EPA's regulations into the PSD sections of the Act (§§160-169). However, Congress made some changes, particularly in the extensiveness of the preconstruction review which is now required.

   One of the most interesting changes in the concept of PSD is that it originally applied only in areas that were "cleaner" than the NAAQS. However, the regulations now extend the PSD preconstruction review to any "major emitting facility" no matter where that facility will be located. The rationale behind the expansion is that a source located in a nonattainment area might affect the air quality in a clean area.

   The basic PSD requirement as set out in Section 165 of the FCAA provides that no major emitting facility (as defined in the Act) for which construction is commenced after August 7, 1977, may be constructed unless:

a. A permit has been issued setting forth emission limitation;
b. An air quality sampling analysis has been conducted;
c. Certain specified increments are not exceeded;
d. Best available control technology (BACT) is applied;
e. The requirements for protection of pristine areas (class 1) have been met;
f. There has been an analysis of any air quality impacts projected for the area as a result of growth associated with the proposed facility; and
g. Monitoring will be conducted to determine the effect of the facility's emissions on air quality.

3. *Nonattainment Areas*

The 1970 version of the FCAA did not include any provision concerning nonattainment. It very optimistically set mid-1977 as the outermost date by which the NAAQS were to be attained. When the attainment date passed, many areas were found to be exceeding one or more of the NAAQS. Under the 1970 Act, the only course of action available was to revise SIPs to ensure attainment and maintenance of the standards. The states and EPA were then faced with the question of what to do about growth in nonattainment areas during the period in which the SIPs were being revised.

In an attempt to ease the problem, EPA developed regulations on emission "tradeoff" or "offset" (Interpretative Ruling of December 21, 1976). Although there was no provision in the 1970 FCAA for such a concept, EPA viewed it as a compromise alternative to a "no growth" policy. Congress apparently agreed because the Clean Air Act Amendments of 1977 specifically adopted the requirements of EPA's Interpretative Ruling as an interim policy, with the exception that the baseline to be used for determination of appropriate emission offsets was the applicable SIP in effect at the time of application for a permit by a proposed major stationary source. For purposes of the offset requirements, a "major" source is defined as one which has a potential emission rate of 100 or more tons per year (1,000 for carbon monoxide). Basically, EPA's Interpretative Ruling was to apply until a revised SIP was adopted (these were to come into effect on July 1, 1979, but most have been delayed). The SIP revision must include requirements for the use of all reasonably available control technology (RACT). This essentially involves a tightening of regulations on existing sources.

Both the Interpretative Ruling and the 1977 Amendments on Nonattainment Area Plans (Part D of Title I) provide that major sources are subject to an air quality analysis, and if the allowable emissions from the proposed source would "exacerbate" a violation of an NAAQS, approval may be granted only if all the following conditions are met:

a. Lowest Achievable Emission Rate (LAER)

In determining LAER, the reviewing authority must consider the most stringent emission limitation contained in any SIP in the country and the lowest emission which is achieved in practice for such type of source. In no event can the specified emission rate be less restrictive than the applicable NSPS.

b. Complete Compliance

All existing sources owned or controlled by the owner or operator of the proposed source in the same air quality control region must be in compliance with all applicable requirements under a SIP or must be under an enforcement order issued pursuant to Section 113 of the FCAA.

c. Reasonable Further Progress (RFP)

Emission offsets from existing sources in the area (whether or not under the same ownership) are required such that total emissions from the existing and proposed sources are sufficiently less than the total allowable emissions from the existing sources under the SIP so as to represent "reasonable further progress" toward attainment of the applicable NAAQS. RFP is essentially a two-part process in which a schedule is first developed and then a yearly tracking exercise is performed. The purpose of an RFP schedule is to verify that the emission reductions obtained are being accomplished at the most reasonable and efficient rate possible so that attainment by the prescribed time can occur.

Many state revisions to SIPs will incorporate offset provisions almost identical to the Interpretative Ruling, but the essential element will be a system to demonstrate reasonable further progress (RFP) toward attainment by the required dates of December 1, 1982 or 1987 (for CO and O_3, if the state can demonstrate the need for a delay).

Chapter 7

State and Local Laws and Administrative Procedures

STATE AND LOCAL LAWS AND ADMINISTRATIVE PROCEDURES

Goal

To present the source of authority for state and local control programs and the various mechanisms for achieving enforcement, focusing on administrative procedures to secure compliance.

Objectives

At the end of this lesson, the student should be able to:

1. State the source of authority for controlling air pollution within the state.
2. Differentiate between common law and statutory law, including reference to nuisance.
3. State the various strategies for processing enforcement actions through the agency and the courts.
4. Explain that neither administrative nor court orders are self-enforcing.
5. Define the process of enforcing orders.
6. State that the nature of enforcement actions is that of "adversary" which is not synonymous with "antagonistic".
7. Explain why the FEO is the keystone of the enforcement process.
8. Decide whether or not to sign a "Waiver of Liability" upon entry when requested to do so by source.
9. Explain the consequences of divulging proprietary process information or confidential business records.
10. Explain how to determine if business records or process data is confidential.

STATE AND LOCAL LAWS AND ADMINISTRATIVE PROCEDURES

Introduction

This unit deals with the legal basis for air pollution statutes and regulations and basic administrative procedures.

Police Power

The police power forms the basis of state and local authority to control air pollution. Simply stated, the policy power is that power reserved to the states by the U.S. Constitution whereby states can establish laws for the preservation of public order and tranquility, the promotion of the public health, safety, and morals, and the prevention, detection and punishment of crimes. As long as pollution control legislation is founded on the need to protect the public health, not much question can be raised about its constitutional validity. However, modern pollution control statutes sometimes cover additional areas such as recreational and aesthetic interests. It is probably safe to say that the strength of a statute's constitutionality decreases as its coverage is extended beyond public health considerations. Therefore, in drafting regulations, a control agency should always attempt to have a reasonable and objective air quality basis for its rules.

Common Law Nuisance

Pollution was labeled a nuisance as early as 1611 when an English Court affirmed the granting of an injunction and awarded damages to a plaintiff upon a showing that defendant had erected "a hog stye so near the house of the plaintiff that the air thereof was corrupted." As common law, it was not a personal environmental right to breathe clean air, but rather a property right which was protected in a nuisance action. The common law nuisance concept is evident in the fact that most clean air statutes today define air pollution as: "the presence in the atmosphere of air contaminants in such concentration and of such duration as are or may tend to be injurious to the public health, welfare and the reasonable use and enjoyment of property." A nuisance theory can be used effectively in areas where there is no air pollution control standard (i.e., odor). In an odor case, the most effective evidence is the testimony of live witnesses who can relate how odors from the source make them ill, keep them awake at night, etc.

In planning a nuisance action, it is helpful for the complainants to keep some sort of diary in order to be as specific as possible about the nuisance conditions. For example, they should record the date, time, and wind direction (if possible) when the odors are the most severe. They must be able to connect the nuisance with the source as well as to show some adverse effect from the nuisance.

Notwithstanding its usefulness in areas not suited to emission limitations, there are a number of problems associated with a nuisance case:

1. It is fairly subjective and it is therefore ill suited to guide engineering and business decisions.

2. The court "balances the equities" and therefore looks at such things as who was there first and how long a person waited before complaining of the nuisance.
3. The interference must generally be of a type which would affect a person of ordinary sensibilities.

The Statutory Approach

Over the last fifty years there has been a trend toward dealing with certain specialized areas of law by creating administrative agencies to "fill in the details" of a broad statutory framework. This has been done very effectively in the area of air pollution control. Legislators establish control agencies which in turn hire technical personnel and develop expertise to enact rules and regulations in specific areas. There are a number of advantages to this emission standard approach:

1. There is more objectivity and predictability.
2. When prosecuting for violation of an emission standard, no harm must be proven because the legislature has, in effect, declared that any emission exceeding the standard is unlawful.

Hearings Prior to Regulation Adoption

In adopting air pollution control standards, agencies not only rely on their own technical personnel but also on input from regulated industries and the general public. One of the most effective mechanisms for obtaining this information is through public hearings. In fact, many federal and state statutes require a public hearing prior to the adoption of a regulation or SIP revision [i.e., §163(c)(1) of the FCAA]. This type of hearing is referred to as legislative or fact-gathering and differs from adjudicatory hearings in that it is not an adversary proceeding and there is generally no cross-examination of witnesses or use of the rules of evidence. The function of this hearing is simply to inform the public of a proposed regulation and to collect information and data on the proposal.

Adjudicatory Hearings

The Federal government and most states have an Administrator Procedure Act which sets out certain requirements for contested case hearings. These hearings are judicial in nature and, in fact, at the federal level the hearings examiners are referred to as Administrative Law Judges.

The term "adversary" should not be confused with "antagonistic". The adversary system simply ensures that the ultimate truth of the matter is reached by the full presentation of all positions and arguments. At these hearings, the parties are generally represented by counsel and the rules of evidence are followed. All witnesses must be subject to cross-examination.

There are a number of areas in which these types of hearings can be very effective:

A. Enforcement Proceedings

When an administrative agency feels that a company is in violation of the statute or the rules but does not have quite enough information for court action, it can benefit from conducting an adjudicatory hearing. These hearings are sometimes called "show cause" hearings and the company or source in question is given notice to appear to "show cause" why an enforcement action should not be initiated. At the hearing, the agency can determine if there is justification for the source's non-compliance status and if there is not, an enforcement order can be entered. This is especially appropriate under Section 112 of the FCAA which provides for the issuance of compliance orders. An administrative order can be extremely useful in that it can set out a detailed timetable for compliance. However, if this administrative order is violated, the control agency must go to court in order to enforce it. Therefore, if a compliance schedule is going to extend over a long period of time, it is generally preferable to have the schedule entered as a court order which can be enforced through contempt of court procedures.

Whether enforcement is sought through administrative or court actions, it is imperative to remember that the field enforcement officer is the most important element in the enforcement process since he is the collector of evidence. All FEOs should recognize that any sample they collect or any violation they observe may be used as evidence in a hearing or in court.

B. Permit Issuance

Adjudicatory hearings can also be used prior to the issuance of construction permits. At these hearings, the applicant would have the burden of proof to demonstrate that it will meet all of the applicable permit requirements. This will be particularly necessary in areas where the air quality increment will be consumed totally or in large part by a single source. The hearing format gives the staff of the control agency and the general public an opportunity to fully examine all aspects of permit issuance. The Federal Clean Air Act recognizes this in requiring a public hearing prior to the issuance of a PSD construction permit under Section 165 of the FCAA.

Chapter 8

Litigation Procedures

LITIGATION PROCEDURES

Goal

To describe the important aspects of the legal enforcement processes and the involvement of the FEO in such cases. Proper courtroom procedures are taught and later demonstrated. See Chapter 9.

Objectives

At the end of this lesson, the student should be able to:

1. Identify the various procedures used in assessing fines, penalties, injunctive relief.
2. Differentiate between civil and criminal action.
3. Define pretrial discovery.
4. Define the meaning of case strategy.
5. Define "deposition".
6. Define an "interrogatory" and tell when it comes into play.
7. Identify the principal rules of evidence.
8. Differentiate between the various kinds of evidence.
9. Compare the effectiveness of direct testimony with the use of such visuals as photographs, charts, maps, etc.
10. Explain the basis for testifying as an "expert witness."
11. State at least five "Do's" and "Don'ts" for a witness when giving testimony on the witness stand.

LITIGATION PROCEDURES

Introduction

This unit summarizes the basic rules of evidence and procedures for trial, with particular emphasis on the role of a witness.

Types of Litigation

Section 113 of the Federal Clean Air Act allows EPA to file civil or criminal actions against persons who commit certain air pollution violations. Most state air control statutes allow only civil actions and most local ordinances are only enforceable through criminal misdemeanor actions. Civil and criminal enforcement actions serve different functions and have different advantages and disadvantages.

A. Civil Actions

This type of action results in the levying of civil penalties and injunctive relief. Statutes generally provide for penalties of $50 to $1,000 per violation and in some cases as high as $25,000 per day. Even though this may seem a tremendous deterrent to polluters, there are situations where it could be cheaper for a violator to pay these penalties rather than to comply. Therefore, one of the most effective air pollution control remedies is an injunction whereby a court orders a source to take certain corrective steps within a given time schedule and to be in final compliance by a certain date. If the source does not comply with the court order, it can be held in contempt of court. A prohibitory injunction can be used to shut down a facility. Such a drastic measure is seldom used and most control agencies prefer to seek mandatory injunctions which set out a timetable for compliance.

B. Criminal Actions

Most local government prosecutions in municipal court involve criminal misdemeanor actions. These are not as well suited for the prosecution of ongoing continuous violations because the fines for misdemeanors are generally set so low that a violator could simply pay a fine and continue to pollute. Furthermore, in the criminal area, courts must be stricter in requiring that a control agency scrupulously observe the constitutional rights of the defendant. In addition, in a criminal case the control agency must prove the violations "beyond a reasonable doubt" rather than simply by "a preponderance of the evidence" as in civil cases. Furthermore, when a criminal action is brought against a corporation, the possibility of jailing a lower echelon employee may not be a sufficiently stringent deterrent. Since most of the litigation in which field enforcement officers will be involved is civil, the discussion of litigation procedures will center on civil actions.

Pretrial Discovery

The key to success in any kind of litigation is preparation. Contrary to some of the popular television shows, there are rarely opportunities to drop "bombshells" in the courtroom since under federal and state rules of procedure there is ample opportunity for both sides to "discover" the evidence which the other side will present in court. In addition, under the federal Freedom of Information Act and state Open Records Acts, control agency records are subject to full disclosure even without discovery procedures.

A. Deposition

A deposition involves the oral questioning of a witness who is under oath. The testimony is not taken in open court but it is reduced to writing and can be used at the time of trial. In general, any prospective witness can be deposed. Depositions serve a number of functions:

1. A general fishing expedition to try to determine what a witness knows or will testify to;
2. To perpetuate the testimony of a witness who will not be available at the time of the trial;
3. To later "impeach" a witness if his testimony at the time of trial is different from his testimony in depositions.

B. Interrogatories

Interrogatories are basically a set of written questions to be answered by a prospective witness in a lawsuit. While interrogatories are cheaper than depositions (i.e., no court reporter is needed; attorneys do not all have to gather for the asking of questions), interrogatories do not provide the flexibility of a deposition. For example, in a deposition, if a witness' answer opens up another area of information, the questioner can immediately proceed to explore this. Also, when a person is responding to written questions, he has more time to "hedge" his response and give only as much information as is absolutely required.

Principal Rules of Evidence

The rules of evidence form the ground rules by which a trial is conducted. They determine whether certain testimony is admissible and they are designed to ensure that a decision is based on proper facts.

A. Hearsay Rule

The hearsay rule prohibits testifying to statements made out of court due to the fact that such statements were not made under oath, there has been no chance for cross-examination, and there is no opportunity to observe the demeanor of the person(s) making the statements. Exceptions to this rule include: declarations of a party to the suit if the declarations are against the party's interest, e.g., a plant owner states, "I know my factory is violating the regulations, but I'm not going to do anything about it;" and business records if made during the regular course of business at or near the time of the event in question (or reasonably soon thereafter) and the person testifying has personal knowledge of how records are kept. Also, expert witnesses can testify to hearsay *within their area of expertise*. For example, a doctor can testify to his review of the literature *in his field*.

B. Best Evidence Rule

Evidence presented must be in the best form for proving the facts in question. For example, the letter itself is the best evidence of what was stated in a letter rather than a witness' recollection of the contents of the letter.

C. Leading a Witness

Counsel may not lead witnesses or ask questions which suggest the answers. This prohibition does not apply to witnesses being cross-examined or to expert witnesses at any time; it does however apply to ordinary witnesses during direct examination.

D. Do's and Don'ts for Witnesses

1. Listen attentively to each question.
2. Think before responding (your attorney may use this opportunity to raise valid objections).
3. Speak slowly and distinctly on the witness stand.
4. Answer questions directly.
5. Avoid extended qualifications or explanations.
6. Do not be long-winded.
7. Do not interpret facts unless called upon to do so as an expert witness.
8. Stick to the facts
9. Be honest: do not stretch facts.
10. Never guess at answering a question.
11. Never hesitate to frankly admit that you don't remember certain physical facts.
12. Never memorize a story.
13. Do not read directly from notes, although notes may be used to refresh your memory.
14. Beware of questions that seek to force a "yes" or "no" answer.
15. Refuse to be ashamed or startled into giving an answer you didn't intend to give.
16. Never argue with opposing counsel.

Chapter 9

Courtroom Procedures

COURTROOM PROCEDURES FILM: THE ROLE OF THE WITNESS

Goal

To show "Role of the Witness" film, demonstrating courtroom procedure. Discuss lessons from the film and prepare for Case Study Exercise, "Trial of Opacity and TSP Violations," Student Exercise No. 3.

Objectives

At the end of this lesson, the student should be able to:

1. Distinguish between effective and ineffective court demeanor by an FEO as he testifies,
2. Differentiate between the kinds of testimony that can be given by the expert witness,
3. More effectively present testimony when called upon to do so,
4. Identify effective use of photographs, maps and charts in giving testimony,
5. React effectively to questioning under cross-examination by the defense attorney,
6. State the role of a judge in the case presented in the film.

THE ROLE OF THE WITNESS

The basic function of the film "The Role of a Witness" is to provide a graphic demonstration of courtroom procedures with particular emphasis on the testimony of a field enforcement officer. Students have an opportunity to observe cross-examination techniques and to see the applicability of rules of evidence in the context of particular testimony.

One of the shortcomings of the movie is that it is fairly old and could be revised to present a more current type of air pollution problem. Furthermore, the movie portrays a private action rather than an enforcement action brought by a control agency. In most cases where a field enforcement officer will be involved, the air pollution control program is the plaintiff.

The basic benefit to be derived from the film is the portrayal of the professional and impartial demeanor of the witness. To that extent, the actor who portrays the field enforcement officer does an excellent job of showing how effective a calm and unbiased presentation can be.

Chapter 10

Overview of the Federal EPA Enforcement Program

OVERVIEW OF THE FEDERAL EPA ENFORCEMENT PROGRAM

Goal

To present the Federal EPA Enforcement Program as directed by the Clean Air Act and to show how this enforcement interacts with state and local air pollution enforcement.

Objectives

At the end of this lesson, the student should be able to:

1. Compare the enforcement responsibilities of the Federal EPA with that of state and local agencies,
2. Name the sections of the CAA which pertain to EPA enforcement responsibilities,
3. Explain how the EPA discretionary enforcement power was limited by the 1977 Amendments,
4. Define two sources of information that trigger a Section 113 action,
5. Name four conditions which must be met before a Delayed Compliance Order can be issued,
6. Explain the various steps required to process and review a Section 113 action,
7. State which Federal Agency represents the EPA in litigation matters,
8. Name the three types of penalties provided by the CAA,
9. State the percent of sources audited by the Federal enforcement program.

Selected Reading

Reference 1, The Clean Air Act: Sections 113 and 114 and Parts C and D.

OVERVIEW OF THE FEDERAL EPA ENFORCEMENT PROGRAM

Introduction

This unit will be concerned with the enforcement posture of the Federal EPA program in carrying out the dictates of the Clean Air Act, with emphasis on the changes brought about by the 1977 Amendments. The material is extracted from notes prepared by R. P. Frye, Attorney-Advisor, Enforcement Division, EPA Region III, (Reference 17) and from talks by other Federal speakers at recent offerings of this course (Reference 18).

Interface with State and Local Enforcement

The CAA as written in 1970 and retained in the 1977 Amendments states that "the prevention and control of air pollution at its source is the primary responsibility of States and local governments."[1] However, Congress in the 1977 Amendments, gave to the Federal government rather specific directions on enforcement which seem to modify somewhat the term "primary responsibility." For example, the states may exercise discretion in choosing an enforcement route, whereas EPA is required to initiate legal proceedings against any major source in violation of a State Implementation Plan.

Fundamentally, EPA's present enforcement strategy is directed to the health related provisions of the SIPs, that is, those which seek to attain the primary NAAQS. The state regulations (i.e., secondary NAAQS) which deal with welfare and nuisance are not presently subject to the Federal enforcement program, since primary emphasis is and must be on enforcement in the substantial numbers of areas of nonattainment of the primary NAAQS. Enforcement of the SIPs, therefore, can be: (a) unilaterally state, (b) federal EPA together with state, or (c) unilaterally federal.

Provisions of the CAA Which Pertain to Federal Enforcement

The provisions of the CAA which establish the Federal enforcement program are:

- Section 113 which requires legal enforcement where major stationary sources are in violation of a SIP
- Section 114 which aids enforcement by providing access to records, requiring continuous monitoring, data reporting, and right of entry.
- Part C (Section 160 *et seq.*) which deals with prevention of significant deterioration, establishing Federal requirements for preconstruction permits.
- Part D (Section 171 *et seq.*) which requires SIP revisions in areas of nonattainment.

Since Chapter 6 of this manual discusses Part C and Part D and since Section 114 provides for enforcement aids, this chapter will be mainly concerned with Section 113 procedures.

Clean Air Act Enforcement

A. Enforcement Prior to the 1977 Amendments

1. Basically, enforcement consisted of negotiations with violators and issuance of administrative orders under Section 113 with extended schedules for compliance.
2. EPA could institute a civil action for an injunction against further violations or could seek criminal penalties where it possessed appropriate evidence to meet the burden of proof (i.e., "knowing" violation; proof beyond a reasonable doubt).

B. Congressional Concerns with the 1970 Law which Led to 1977 Amendments

1. There was no public participation in the administrative enforcement process.
2. There were no standards for EPA issuance of administrative orders under Section 113.
3. The desire of Congress to force technology development upon industry.

C. Clean Air Act Amendments of 1977

The 1977 Amendments drastically changed the nature and scope of Federal enforcement actions.

1. The enforcement discretion was restricted and EPA is required to sue any major stationary source in violation of a SIP more than thirty days after the Administrator notifies the source of said violation.

   A copy of the notice of violation is sent to the state involved to afford the state an opportunity to take enforcement action within the thirty day period.
2. All existing state and federal consent orders and decrees inconsistent with Section 113(d) of the Act, and in existence at the time of the Amendments, were voided by Section 113(d)(12).
3. Availability of administrative orders for compliance is limited to:
   a. Section 113(a) orders, which prior to the 1977 Amendments were issued with extended compliance schedules, may now be issued only to require immediate compliance, which EPA has interpreted to mean compliance within thirty days.
   b. Section 113(d) orders, "Delayed Compliance Orders," (DCO) may be issued by a state, or by the administrator after he gives thirty days notice to the state. A valid Section 113(d) order effectively insulates the holder

from federal enforcement under the CAA and from citizen suits pursuant to Section 304 of the Act. The following requirements, among others, must be met:

- Before a DCO may be issued, there must be notice to the public and opportunity for public hearing.
- Such DCO becomes a part of the applicable SIP.
- The DCO, in addition to containing the final compliance deadline, must require an interim compliance schedule containing increments of progress.
- The DCO requires emission monitoring and reporting by the source.
- Final compliance date is not later than July 1, 1979 or three years after the date for final compliance specified in the SIP (except Section 113(d)(4) order which may allow a greater time for compliance).

c. Special types of Section 113 orders include:

- *Shut down orders* with no interim schedule of compliance in which case the source may operate until July 1, 1979 *provided* a bond is posted equal to the cost of compliance and any economic benefit which may accrue to the source owner by reason of failure to comply.
- *Innovative technology.* Under Section 113(d)(4), is a source is determined to be utilizing innovative technology to conform with an emission limitation, it has five years after the effective date of the emission limitation to comply.

  Innovative technology must be sure that it will result in a substantial likelihood of achieving greater continuous emission reduction or achieving equivalent reduction with lower energy cost than would otherwise be achieved.
- *Conversion to coal from gas or oil.* Section 113(d)(5) gives sources converting to coal until December 31, 1980 to comply with the SIP.

Processing Section 113 Enforcement Actions[18(b)]

The procedural process of Section 113 notices begin when a violation at a major source becomes evident to EPA. Regular reports on compliance status are made by the states to the EPA Regional offices. These reports are monitored and those which show violation are singled out for action. EPA triggers Section 113 notices from state reports or from the results of field inspections by their own personnel.

Notification of violation is sent to the source owner by letter or in legal document form (used by Region IX).

The next step is usually an informal conference requested by the legal counsel for the source owner (although EPA is not legally required to so confer). This step is not an adjudication or formal hearing but it has an air of formality as it is held in a public building with a stenographer present. Totally informal conferences, as over lunch, are detrimental and should be avoided.

The state agency is invited and is often represented by a senior enforcement official or the FEO who supervises the source. EPA wants to know the state's position with respect to the violation and utilizes the state reports and other documents containing evidence supporting the conclusion that a violation exists.

From the conference, an order is produced that compliance be achieved by the source within thirty days. The order says what the source owner must do within thirty days and if it is not done, the source owner is in violation of the law. If a suit is later instituted, it may be based on failing to comply with a lawful order of EPA and violation of the SIP.

It does not always follow that the informal conference produces an EPA order. If it becomes apparant that the state will take action, the Federal order may be delayed or is not drawn.

For EPA to get into court:

- A litigation report must be prepared. The report must contain a persuasive statement of the facts and the law in support of litigation.
- The report is reviewed by the EPA Washington legal staff.
- A policy review is then given.
- The report is then sent to the Department of Justice. If the Justice Department staff approves, it goes to the Assistant Attorney General for signing.
- If signed, the matter is sent to the U.S. Attorney General for action.
- All the while the EPA and Justice Department are reviewing, the case could be immediately stopped if the state takes effective action to prosecute the violation. When this happens, the EPA action immediately stops, if EPA determines that state action is adequate.

Penalties

A. Criminal

For knowing violations, up to $25,000 per day of violation or up to one year imprisonment or both.

B. Civil

The statutory maximum civil penalty is $25,000 per source per day of violation after August 7, 1977. This is a new provision with the 1977 Amendments.

C. Section 120 Administrative Penalties

The administrator of EPA or the state may assess a noncompliance penalty against a major source after July 1, 1979. The amount of the penalty can be no less than the economic value which a delay in compliance beyond July 1, 1979 may have for the source owner. Section 120 penalties are appealable to the U. S. Court of Appeals.

Audit by EPA of State Source Inspections

It is the general policy of EPA to make a ten percent audit of the state's source by source inspection program. The methods differ between EPA regional offices. The states may be advised in advance and actually make the inspection in company of the EPA inspector. In some cases the EPA will conduct the source inspection independently of the state which may give rise to controversy over differing interpretations of the SIP. Where manpower is available, audit inspections should be made in the company of state or local field enforcement personnel.

Chapter 11

Complaint Handling: Odor Complaint Case Study

COMPLAINT HANDLING

Goal

To teach the principles of processing nuisance complaints with emphasis on the field investigation process.

Objectives

At the end of this lesson, the student should be able to:

1. Identify at least five sources of citizen complaint,
2. Identify the major information points necessary in receiving citizen nuisance complaint,
3. Document the procedure for investigation and case development of public nuisance complaint,
4. Define the various steps in getting action to abate the source of the complaint from the responsible parties,
5. Identify various means of evaluating complaint conditions by measurement of effects,
6. Differentiate between a public and private nuisance.

Selected Reading

Reference 9, Chapter 4, Interviewing.

COMPLAINT HANDLING

Introduction

Responding to citizen complaint of air pollution nuisance is an important task of the FEO. It often can be time consuming with great difficulties in legal prosecution, should such procedure be necessary to secure abatement of a public nuisance.

Public Nuisance, Legal Aspects

The inherent responsibility for enforcement against public nuisance starts with state and local statutes. A typical regulation might read:

> ".....No person shall discharge from any source whatsoever such quantity of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public....."

The legislative intent is quite clear that no one should cause a public nuisance. A "considerable number of persons" which defines the public nuisance in the foregoing regulation has not been defined, and therefore is vague and causes problems of enforcement of the nuisance regulations. Some agencies have given as a rule of thumb, "ten separate households" as defining "considerable number" and then proceed with less if the situation is very bad, or requires more if the nuisance is marginal.

An emission that affects only one person is a private nuisance and is not subject to prosecution under the above quoted statute. However, the agency has a responsibility to respond to all nuisance complaints, including those from a single complainant, and should attempt to alleviate the nuisance situation. A single individual who suffers a nuisance is free to take legal action, seeking damages or injunction, against the suspected source. In such an action, the enforcement officer may be called as a witness to testify to the extent or effect of the nuisance.

Causes of Nuisance Complaint

To assist the receiving operator, a list of typical situations which cause complaints could be posted and referred to as a helpful guide. Complaints are triggered by one or more of the following:

- Offensive odors;
- A specific violation, most probably opacity;
- Large particle fallout, easily visible on porches, lawn furniture, and plants, etc., but difficult to identify the source;
- Fugitive dust from construction or demolition;
- Plant or materials damage;
- Fugitive dust from industrial source;
- Episodal release affecting health;

- Open burning;
- General conditions such as "The air is awful today, my eyes burn, throat is sore, etc."

Receiving a Complaint

A complaint of nuisance is transmitted to the agency by telephone, by letter, by personal visit, or by referral from a central reporting agency for all types of citizen contacts.

Most serious complaints are phoned in to a receiving clerk of the agency who should be trained and experienced in processing such calls. Often the caller is irritated and emotional, rather than factual. Under such circumstances, the caller should be allowed to talk himself out, and then questioned to get the facts the operator needs for proper dispatching of the FEO.

An agency might prepare a form which includes the information needed from the caller. A list of questions helpful to the operator would include:

- What is your full name, address, and phone number?
- What is the condition complained of?
- Where do you think it is coming from?
- Is it going on now?
- When did it start?
- Have there been other occurrences? Get specific dates and times.
- Is anyone reported getting sick?
- Are other people bothered?
- Listen for other specific data related to the event.

The complaint form should include the date, time and name of person taking the complaint and time of dispatch.

After the message log is completed, a complaint number is assigned, the time is stamped on the log and a field enforcement officer is dispatched immediately to the scene. Complaints are investigated as speedily as possible to ensure that the reported source may be reached while the violation or nuisance is still in progress.

Complaint Investigation

If he works in a district, the FEO may already know much of the background of the source. However, he should check the source file to obtain the recent history.

Upon arrival in the vicinity, the enforcement officer first observes the alleged source to determine if a violation is involved. If a violation is observed, he investigates, writes and serves a notice, if warranted. Then he visits the complainant. However, if no violation is immediately apparent, the complainant is contacted.

Some agencies will have the FEO first contact the complainant, then proceed to the suspected source for investigation. Either this procedure or the above is acceptable.

A. Complainant Interview

The enforcement officer makes every effort possible to *avoid obvious identification* of the complainant. He is particularly careful not to park his official vehicle too close to the complainant's residence should the complainant and the source be near each other. The identities of all complainants should be considered to be confidential and should not be disclosed to anyone who is not an employee of the enforcement agency.

If the *complainant is not at home* the enforcement officer should leave a message. If the complainant is at home, the enforcement officer identifies himself by name and agency in a friendly manner, and proceeds with the interview.

The *enforcement officer is friendly, but dispassionate.* He generally employs a "nondirective" interview technique in that he allows the complainant to get the matter off his chest so that the facts of the situation can be calmly discussed. He should also appreciate the fact that a person who is angry may be honestly motivated by a serious or chronic air pollution condition.

In permitting the complainant to *speak his mind*, it is best that the enforcement officer not interrupt. It is particularly effective, however, that when facts appear the officer repeats them aloud for verification and then writes them down.

After the complainant has expressed himself, the enforcement officer then proceeds on a line of questioning which will determine (1) the *cause* of the complaint and (2) the *nature* and *source* of the air pollution problem cited in the complaint. The line of questioning in this case is intended to complete and verify the data supplied by the complainant.

The *cause of the complaint* may not always involve air pollution. Although most complaints are justified, some will concern problems over which the agency has little or no control and in which air pollution may play a minor role. These concern backyard feuds, natural contaminants, resentment towards a nearby company or low concentrations of contaminants which may affect illness or allergy in an individual. Although the enforcement officer may have no legal powers in such cases, he thoroughly investigates and attempts to correct all air pollution problems. If such complaints are unsubstantiated, he establishes the *cause* of the complaint and documents the fact that no violation has occurred by recording the operational data of the equipment at the alleged source.

The information given by phone is checked and enlarged to include the following:

- Name and location of source complained of,
- Frequency of annoyance or occurrence of plume,
- Time of day nuisance was first noticed,
- Duration of nuisance at each occurrence,
- Names and addresses of persons affected,
- Location and extent of property damage, if any,
- Description and frequency of any illness alleged to have resulted from the air contaminants,
- Description of odors or any other pollutants that may be involved,
- Any other information the complainant may have that will relate the nuisance to a specific piece of equipment.

In an air pollution problem which *appears to involve toxicity*, the enforcement officer records all observed or reported symptoms such as:

nausea
vomiting
headache
eye irritation
fever
constriction of chest
eye tearing
soreness of throat
nasal discharge
turning blue
cough
difficulty of breathing, etc.

If the symptoms appear serious, a physician and the health authorities should be contacted. The enforcement agency should be contacted. The enforcement agency should also be immediately notified in order that an emergency vehicle may be dispatched to the scene to measure the concentrations of any possible toxic contaminant.

It should be noted that *only a physician can make a diagnosis*. The enforcement officer records reported symptoms in his report. The enforcement officer can note the name of the physician conducting the diagnosis and treatment. This information is important if public nuisance action should be initiated.

While interviewing complainants, the enforcement officer *does not promise legal action* nor does he commit himself or the control agency to any course of action. He should, however, explain to the complainant the laws involved and the evidence required to instigate legal proceedings. But he will also explain that he will first attempt to seek cooperation on the part of those who may be responsible.

If odors, soiling or other property effects are involved, the *enforcement officer examines the citizen's property*. The pattern of fallout of contaminants may indicate the direction from which they came. If a malodor is detected at the complainant's property, the wind direction can be determined for the purpose of tracing the odor to its source.

As a rule, enforcement officers do not solicit opinions in a neighborhood regarding the behavior of any plant, but confine themselves to those persons volunteering complaints. It is usually citizens who do the canvassing and who supply the information. The enforcement officer may then interview all complainants involved. The canvassing of complainants is usually discouraged. The enforcement officer does not sample nor act on opinion, but on sincerely motivated complaints. The canvassing of the neighborhood can be construed in a court of law as being prejudicial to the plant.

The enforcement officer, on the basis of his knowledge of air pollution, however, *evaluates the consistency, correspondence and intensity of remarks* made by possible witnesses. He attempts to find some degree of unanimity regarding the objectionability of the problem among those who might be equally affected. Diverse opinions and inconsistencies are first signs that a public nuisance case may not be easily developed.

B. Inspection of the Source

From the facts gathered so far, the enforcement officer may have a notion of the specific or type of source responsible, especially if he has identified contaminants and has observed definite evidence of damage or detected odors on the complainant's property. In other cases, he may know the identity of the contaminants, but not the source of origin. In still other cases, the contaminants may be completely unknown.

To establish a public nuisance, a source within a certain facility responsible for the offending emission must be proved. In some cases, the equipment involved may be obvious; in others, especially in a plant containing many pieces of equipment, the source may be difficult to locate. In the latter instance, each piece of equipment must be inspected in detail. Those which do not contribute to the problem are eliminated from consideration.

Quite often the job is completed if the complaint or nuisance also involves a violation of the rules and regulations through the emission of contaminants in excess of that allowed, or through the operation of unpermitted equipment, or through operation of equipment contrary to permit conditions. In these instances, the action to be taken is indicated.

If, however, the nuisance is a result of quantities of air pollution which are allowed by quantitative standards in the Rules and Regulations, a public nuisance will have to be proven.

When the enforcement officer contacts the plant operator, he explains that he is investigating a complaint, unless, in the individual instance it should be strategic not to do so. The enforcement officer may also explain that he is trying to determine whether or not the complaint is justified. This gives management the opportunity to state its case, since it knows that the enforcement officer is not yet committed to any action. As with the complainant, he is also attentive and takes notes. Then, on the basis of the information he acquires from the complainants, he asks developmental questions and completes the story. He then inspects the equipment and compares actual operating conditions, cycles and times of operation with the times and frequencies of complaints.

Resolution of the Nuisance

Because the enforcement officer is an indifferent observer between two parties in conflict, he has a natural tendency to act as mediator and will attempt to find that solution to a problem which will satisfy both the complainant and the operator.

After the problem is identified and the specific source is isolated, means of abatement may then be determined. If the problem was a single occurrence, it probably was not anticipated, was perhaps caused by a breakdown, a fire, a power shortage or some other situation equally unforseen. The chances of this same incident happening again are slim, preventative action unlikely, and corrective measures unnecessary except to repair or compensate for damages. Where the problem is operator error, then it becomes the company's responsibility to ensure that personnel are adequately trained.

When the problem is continuing or recurrent, then it becomes critical to eliminate the cause. Occasionally, an improved regular maintenance program will abate the problem, either by reducing the likelihood of a breakdown or by preventing a buildup of material causing fugitive dust or odor emissions.

Sometimes the problem can be solved by altering the operation or process somewhat, without actually altering the equipment. This may involve changes in the processing rate or throughput, changes in operating conditions such as temperature, or changes in material being processed. Relocation of the equipment within the plant premises may also solve the problem. Ideally, when the equipment is first put into operation, those operating conditions which could cause a public nuisance should be anticipated. Restrictions or conditions can be imposed on the operating permit limiting the operations to that which will not cause a nuisance.

The most common solution involves replacing the basic equipment with newer, more air pollution efficient equipment or the installation of adequate control equipment. After-burners, adsorbers and scrubbers have all been used successfully to reduce odors; electrostatic precipitators, cyclones and scrubbers have been effective with particulate matter.

Enforcement

The most difficult type of air pollution case is the public nuisance. A public nuisance frequently occurs when a number of persons are annoyed by a quantity of contaminants which is otherwise allowed. The problem in cases of alleged public nuisance is to determine whether a private dispute or a valid public dispute is involved. If a private dispute is involved, then the citizen must initiate his own legal action. A public nuisance, however, involving a "considerable number of persons" or a reasonable cross-section of the immediate community affected is handled as an enforcement action.

Chapter 12

Odor Detection and Evaluation

ODOR DETECTION AND EVALUATION

Goal

To teach the principles of odor detection and evaluation.

Objectives

At the end of this lesson, the student should be able to:

1. Define odor and odorant.
2. Identify the characteristics of odor perception.
3. State the four odor parameters.
4. Name which parameter is used in odor regulations.
5. Explain why odor measurement by instruments is difficult.
6. Define "odor unit".
7. Name three instruments which aid odor threshold measurement.
8. Identify the characteristics of odor transport from source to receptor.
9. Explain a means of tracing an odor source.

Selected Reading

References 22, 25 and 26

ODOR DETECTION AND EVALUATION

Introduction

All air pollutant emissions of concern from the standpoint of field operations divide into those which are *perceptible* to the human observer (e.g., enforcement officers, complainants), and those which are *imperceptible*. Imperceptible contaminants cannot be consciously perceived through the senses (seeing, hearing, smelling, feeling, touching) at normal ambient concentrations and can include such contaminants as carbon monoxide, hydrocarbons, and oxides of nitrogen. They are primarily detected and measured through ambient air sampling and source sampling and analysis.

The perceptible emissions are those, like dust, smoke, and fumes which can be seen, or leaking gases which can be heard, or gases and vapors which can be detected through the sense of smell. The field enforcement officer's stock-in-trade are these forms of emissions. Indeed, he should be trained to be an expert in detecting, describing, quantifying these emissions and in establishing their sources and causes.

Evaluation of Odors

The problem in the evaluation of odors is essentially that there are no reliable objective methods for field identification of specific compounds and conditions causing the odors, or for quantifying the concentration of odorants in the ambient environment. These aspects of odor evaluation must be treated as scientific investigations. Nevertheless, a trained enforcement officer should be sufficiently expert in odor evaluation so that:

1. He can objectively evaluate the perception and his own level of odor sensitivity in relation to complainants and the general population.
2. He has thorough knowledge of the sources which produce odors and the physical conditions that affect odor potentials.
3. He can identify odors in the field.
4. He has knowledge of the conditions which affect odor perception and of scientific techniques used in odor evaluation.

Thus, to be an expert, the enforcement officer should have knowledge of both the perceptual and the scientific aspects of odor investigation. These are treated in this section.

Characteristics of Odors and Odorants

A major difficulty in dealing with odors as an air pollution problem arises from the fact that an odor is not an air contaminant but is a property of air contaminants which can only be detected or measured through its effects on the human organism. Briefly, an odor is that property of a substance which affects the sense of smell. A contaminant which has an odor is called an odorant.

Odor Perception Varies with Individuals

The capacity in humans to perceive odors varies considerably among individuals, and in one individual from time to time. Some persons ("anosmiacs") are very insensitive to odors, while others may be acutely sensitive to odors unnoticed by most people. This variability of individual sensitivity complicates the problem of estimating the prevalence of an odor nuisance.

Legal Criteria

The air pollution inspector is primarily interested in establishing the existence of an odor problem according to legal criteria: i.e., a problem which constitutes a nuisance to a considerable number of persons over a continuing or significant period of time. Both of these elements are important from a practical standpoint, since there is little value in devoting substantial effort to the solution of a nonrecurrent problem or one not affecting an appreciable number of persons in the community.

FEO Concerns

In such problems, the inspector is concerned with (1) identifying the odor, (2) rating the odor's intensity, (3) identifying the odorant, (4) establishing the frequency of the nuisance, (5) locating the "odor route," (6) locating the source of the odorant, and (7) influencing some operational or engineering control over the odorant.

A. *Odor Perception*

There are a few characteristics about odor perception which the enforcement officer should be familiar with in estimating whether an odor problem exists. These are as follows:

1. The olfactory sense becomes fatigued after continuous perception of an odor.
2. An odor is usually detected whenever there has been a significant change in odor quality or intensity. A pleasant odor can become objectionable to one who has become used to it under continuous exposure, when it increases in intensity.
3. Odors do not, in themselves, cause physical disease. The odor of many toxic materials (e.g., chlorine, sulfur dioxide, hydrogen sulfide) may serve as a warning agent, however. Odors, also, may bring on nausea and have an adverse effect on asthmatics.
4. A person's ability to perceive odors varies from day to day.
5. Compounds of different constitution may yield similar odors, whereas compounds of very similar constitution may yield different odors.
6. An unfamiliar odor is more likely to cause complaints than a familiar one.
7. The perception level of odors decreases with increasing humidity. High humidity tends, however, to concentrate odors in a given locality.
8. Odor quality may change upon dilution.
9. Some persons can detect certain odor qualities but not others.

B. *Definitions*

Odor is "a sensation of smell perceived as a result of olfactory stimulus".

Odorant is "the substance which causes odor".

Odor Parameters

In investigating odor complaints to establish the existence of a nuisance, the enforcement officer should attempt to identify the odorant, describe the odor and establish its objectionability, and provide some indication as to its severity. Nader[19] in describing perceptual measurements of odors in the laboratory, defines the following set of parameters pertinent to such an evaluation.

- Quality
- Intensity
- Acceptability
- Pervasiveness

Although developed primarily for experimental use, these parameters are also useful for characterizing odors in the field. Skill in evaluating odors lies in the ability to distinguish the separate characteristics of the odor, and in isolating the smell from other senses (taste, feel, sight and hearing). Normally sensitive persons can develop such skill through training.

A. Quality

The quality of an odor may be described either in terms of association with a familiar odorant, such as coffee, onions, etc. (characteristic odors) or by associating a familiar odor with an unfamiliar odorant. Aside from such direct descriptive terms, the observer, in an attempt to be complete and accurate, may add modifiers to his description to indicate shades or overtones of an odor. These may actually include subjective reactions such as "fragrant," "foul" and "nauseating," or characteristics of odor which may be associated with the sense of taste such as "bitter," "sweet," "sour," "burnt," or even partially with the sense of touch as far as contaminants which are irritating are concerned, such as "pungent," "acrid," "acidic," and "stinging." As a matter of fact, a contaminant may sometimes affect more than one sense. An irritant can be smelled, cause eye-irritation and be tasted.

Odor Recognition Training

Odor terminology is meaningless without actual exposure through odor training. Therefore, the inspector should be exposed to samples of typical odorants found in the local industry, so that he can be prepared to make quick and accurate identifications. There is no substitute for this kind of training. Verbal descriptions of odors do not implant as vivid an imagery in the mind as do descriptions of visual or auditory phenomena.

A few of the well-known odor classification systems are indicated here. They are useful in training inspectors in making associations and analyzing the various component sensations which odors may produce. For field purposes, one system is as good as another. The advantage of all systems is that they yield a useable odor vocabulary, as shown in Table 12-1 and below.

Based on Six Types of Odor Classification

1. Spicy: Conspicuous in cloves, cinnamon, nutmeg, etc.
2. Flowery: Conspicuous in heliotrope, jasmine, etc.
3. Fruity: Conspicuous in apple, orange oil, vinegar, etc.
4. Resinous: Conspicuous in coniferous oils and turpentine.
5. Foul: Conspicuous in hydrogen sulfide and products of decay.
6. Burnt: Conspicuous in tarry and scorched substances.

Crocker-Henderson Classification
A Condensation of the Henning Arrangement

1. Fragrant or sweet
2. Acid or sour
3. Burnt or empyreumatic
4. Caprylic, goaty, or oenanthic

Table 12-1. Henning's odor classification.

B. Intensity

Intensity is described by some numerical or verbal indication of the strength of an odor. Various intensity scales have been devised. The average observer or complainant can be expected to distinguish three levels of intensity, characterized as weak, medium and strong. A useful rating system especially adapted for field work is as follows:

Rating	Description
0	No detectable odor
1	Odor barely detectable.
2	Odor distinct and definite, any unpleasant characteristics recognizeable
3	Odor strong enough to cause attempts at avoidance
4	Odor overpowering, intolerable for any appreciable time

This system depends on observation or reporting of behavior more than on subjective impressions of the complainant. The fact that a person desperately attempts to avoid a strong and unpleasant odor is clear and verifiable indication of its intensity. Reports of odor intensities of 2 or higher on this scale may be particularly relevant in establishing the existence of a legal nuisance.

For scientific purposes, on the other hand, an odor rating which does not depend so heavily on the objectionable character of an odor is usually preferable. Such a system, long used by expert evaluators, is the following:

Intensity	Expert Description
0	No odor
1	Very faint
2	Faint
3	Easily noticeable
4	Strong
5	Very strong

This system has the advantage of distinguishing the intensity parameter from the acceptability parameter in a more definite manner.

C. Acceptability

An odor may be either acceptable or unacceptable depending on its intensity and quality. Thus odors normally considered as pleasant, such as flower fragrances and perfumes, may become unacceptable only at very high concentrations (i.e., at very high intensities on the scientific scale) whereas obnoxious odors may be unacceptable at much lower concentrations, where they are not clearly recognizeable.

D. Pervasiveness

The parameter of pervasiveness refers to the tendency of an odor to resist being dissipated by dilution of the air in which it occurs. Pervasiveness in this sense is related to the nature of odorant and is not readily determined except by experiment. Nevertheless, a highly pervasive odor is one which, in the field, will tend to be detectable in sheltered areas over a longer period of time, and will therefore in some incidents be easier to track than a less pervasive one.

Determinants of Odor Perception

Odor is a property of an odorant, but the report of a perceived odor is mediated by the nervous system and the brain of an observer. Therefore differences in reports of odor perceptions may be due partly to differences in the physical conditions of exposure, and partly to differences in the physiological and psychological status of the observer. In view of these considerations, the main parameters determining an odor report may be listed as

- Identity of odorant (or odorants)
- Concentration(s) of odorant(s)
- Ambient conditions
- Status of observer

The relevance of these parameters to problems of odor evaluation is discussed in the following subsections.

Identity of Odorant

The field enforcement officer should be trained to identify the odorants most often responsible for complaints within his area. So trained, he can often identify the cause of an odor problem by his own investigation in the field, even when the complainants are uncertain as to the nature or origin of the odor.

Complaint	Identification
Rotten eggs	H_2S
Rotten cabbage	Mercaptan
Natural gas	Mercaptan
Dead fish	Di-methylamine
Outhouse	Amines
Rotten odor	Rendering
Scorched popcorn	Grain drying by direct flame
Coffee	Coffee roasting
Bleach	Chlorine
Ammonia	Ammonia
Phenol	Phenol

Table 12-2. Interpretation of odor complaints.

One difficulty that arises in the endeavor to associate particular odorants with their odors is that the chemical identities of odorous industrial air contaminants are not always known. Further, in some cases the odors are caused by mixtures of odorants which may vary in their proportions under different conditions of production; these variations can lead to changes in perceived odor quality, but usually within some limited range which does not prevent recognition by a trained observer.

Another complication in the recognition problem arises from the fact that odor quality may change with dilution. In mixtures of odorants this may be due to a difference in pervasiveness of the individual compounds; however, single odorants sometimes behave similarly.

Status of Observer

The principal parameters of observer status which are relevant to odor evaluation may be listed as sensitivity, expertise, and physiological and psychological conditioning.

1. *Sensitivity*

The sensitivity of observers for any given odor varies widely, and the relative sensitivities of two observers vary inconsistently for different odors. Furthermore, independent observers often disagree substantially regarding odor quality, particularly when evaluating odors of mixed odorants. For these reasons statistical evaluations using panels of observers are more likely to provide reliable results than evaluations by individual observers.

2. ***Expertise and Training***

As discussed above, expertise can be developed to a considerable extent by study and training, although it is necessarily limited by the physiological sensitivity of the would-be expert. With respect to quality, expertise consists in the ability to recognize and discriminate between a number of odorants, either singly or in mixtures. Relative to intensity, expertise permits reliable discrimination between a large number of graded levels of intensity. Thus, a trained person can detect a smaller percentage difference in concentration levels of a given odorant than an untrained individual.

3. ***Physiological and Psychological Condition***

A problem of physiological origin, in the evaluation or tracking of odors, is fatigue of the olfactory nerves, which tends to diminish the sensitivity of the evaluator. The effect is especially noticeable after prolonged exposure to a rather high intensity of odor, and may seriously complicate the conduct and interpretation of odorant threshold determinations in the laboratory.

Colds and other infections of the nasopharyngal tract can cause serious, if temporary, interference with the sense of smell and result in loss of sensitivity to many odorants. For observers in an odor panel, a preparation of a standard odor can be useful in checking on these variations in sensitivity from day to day; at least when the condition is not too obvious to need confirmation.

Measurement of Odor Intensity

A. Threshold Concentration

The threshold of odor in the ambient air is the main parameter determining the intensity of the perceived odor, although ambient conditions and observer status may cause appreciable variations in perceived intensity. Leonardos[25] published the threshold concentration in ppm by volume for fifty-two chemical compounds, several of which are shown in Table 12-3.

Chemical	Threshold ppm by volume	Description
Acetone	100.0	Chemical
Acrolein	0.21	Burnt, pungent
Trimethylamine	0.00021	Fishy
Ammonia	46.8	Barn-like
Benzene	4.68	Solvent
Hydrogen sulfide	0.00047	Rotten egg
Dimethylamine	0.5	Fishy

Table 12-3. Odorant threshold concentrations.

This data shows that the volume of odorant present to cause threshold levels varies widely. For example, when ammonia and hydrogen sulfide samples are each diluted with air and are of equal volumes, the volume of ammonia required would be 100,000 times that of the volume of hydrogen sulfide to reach a concentration of ammonia that can be perceived.

B. Units of Intensity Measurement (Odor Concentration)

Since the concentration of an odorant to produce a threshold of odor varies widely, the instrumental measurement of concentration is unlikely to produce any measure of odor intensity above the threshold of perception.

A developing approach to odor intensity evaluation is to sample an odorous atmosphere or effluent stream and dilute the sample with odor free air until a threshold is determined by a panel of observers or a "trained observer". Thus, a "dilution factor" can be quasi-objectively obtained. "Dilution factor" is the ratio of the diluted volume to the original sample.

For the single "trained observer", threshold is the point at which the perception of odor just begins. When a panel is used, threshold is determined by plotting, on log-probability coordinates, the percentage of the panel indicating positive odor responses vs. the "dilution factor" of the prepared samples presented to the individual panel members. The resulting curve tends to follow a straight line and the point where the plotted line crosses the 50% panel response ordinate is the threshold concentration. The "dilution factor" at the threshold is the odor concentration usually stated in terms of odor units per cubic foot (see page 934 of Reference 7).

"Odor Unit" is defined as the amount of odor necessary to contaminate one cubic foot of odor free air to the threshold, or barely perceptible, level (see page 311 of Reference 22).

C. Method of Determination

Any procedure which permits a sampling of the odorous air, diluting it with a measured amount of odor-free air, and presenting the diluted mixture to a panel of observers or a trained observer is satisfactory.

The calculations are quite simple.

$$\frac{\textit{Sample volume} + \textit{odor free volume}}{\textit{Sample volume}} = \textit{odor strength}$$

as odor units per cubic foot.

Example:

$$\textit{Odorous} + \textit{Odor free} = \textit{Mix}$$

$$5ml + 95ml = 100ml$$

$$\textit{Sample} + \textit{Dilution air} = \textit{Mix, presented to observer}$$

$$\frac{5\,\cancel{m}l + 95\,\cancel{m}l}{5\,\cancel{m}l} = \frac{100}{5} = 20, \textit{ which is the dilution factor}$$

If a single trained observer judged the above "mix" to be at threshold, then the original sample would have 20 odor units per cubic foot.

If a panel had been used, and the 50% response ordinate intersected the plotted response line at a dilution factor of 20, then the original sample would have an odor concentration of 20 odor units per cubic foot.

D. Quantitative Emission Rate

Odor emission can be calculated as an emission rate from odor concentration in "Odor Units."

Example:

A source tested to have a concentration of 20 odor units (per cubic foot) and a volume flow of 10,000 acfm has an

Emission Rate of

$$\frac{20 \text{ odor units}}{cu/ft} \times \frac{10000 \ cu/ft}{min} = \frac{200{,}000 \text{ odor units}}{min}$$

Note: By using the Emission Rate, an Odor Emission Inventory can be constructed.

Instruments

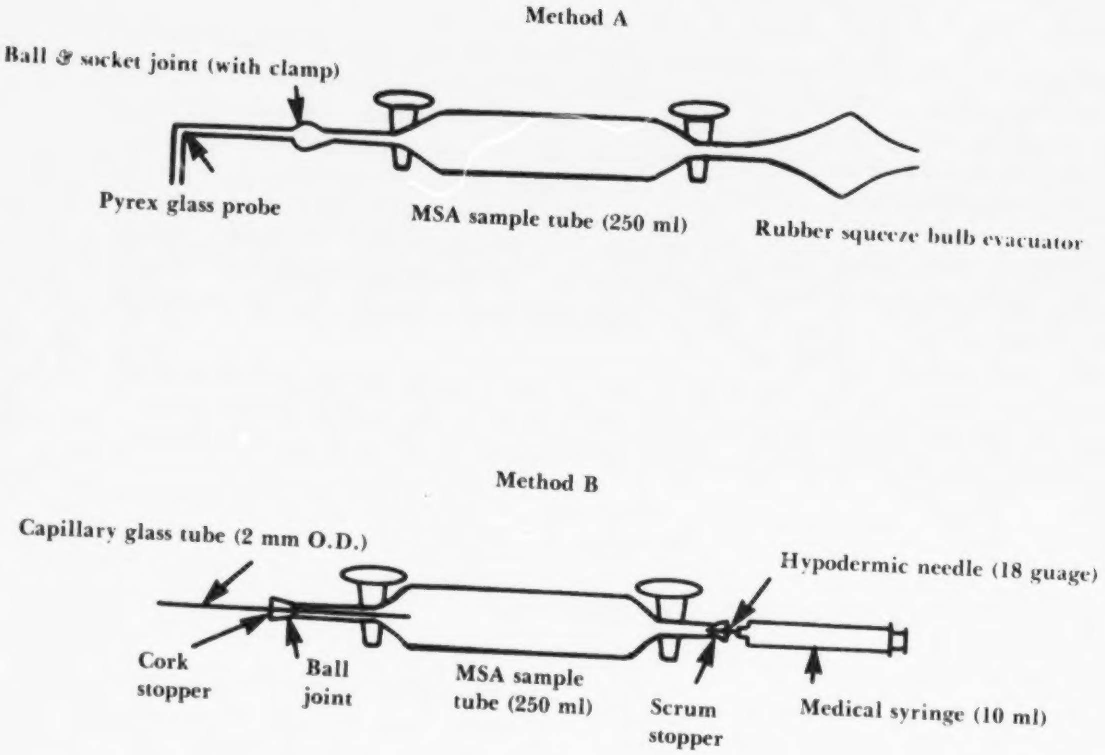
A. Sampling for Later Evaluation

To confirm field estimates of odor intensity, or to determine odor removal efficiency of control equipment, the investigator may collect samples of odorous gases of low moisture content by means of a glass probe connected by a ball and socket joint with clamp to a gas collection tube (e.g., a 250 ml MSA sample tube) as shown in Figure 12-1. The odorous gas is drawn into the tube by a rubber squeeze bulb evacuator. (Rubber or plastic tubing or other absorptive or heat sensitive materials on the probe side of the sample tube should not be used.)

For gases with high moisture content, such as may be found in steam plumes, precautions are required to prevent condensation of water vapor and possible absorption of odorants in the liquid. This can be achieved by using a syringe and hypodermic needle to aspirate a smaller sample into the sample tube, previously filled with odor-free air. A system of this sort is also illustrated in Figure 12-1. (A capillary probe may be used, to minimize error due to dead space in the probe.)

Sampling problems that must be dealt with include: (1) if sample is warm, condensation and cooling may result in the selective removal of odorants from the vapor phase; (2) odorous material may be sorbed on the walls of containers and on particulates in sample; (3) chemical changes after sampling may alter the odorant, etc.

A test kit convenient for field use consists of six 250 ml sample tubes, a hand aspirator, and several probes of glass tubing with ball joints for attachment to the sample tubes. A special capillary probe and syringe with hypodermic needle, for sampling gases of high moisture content, may also be included.



Method A

Method B

Ball & socket joint (with clamp)
Pyrex glass probe
MSA sample tube (250 ml)
Rubber squeeze bulb evacuator
Capillary glass tube (2 mm O.D.)
Hypodermic needle (18 guage)
Cork stopper
Ball joint
MSA sample tube (250 ml)
Scrum stopper
Medical syringe (10 ml)

Figure 12-1. Schematic diagrams of odor sampling apparatus. Method "A" is used to collect samples low in moisture content; Method "B," samples high in moisture content. The latter method permits primary dilution of odor sample in the field, and minimizes condensation of vapors on the inner surface of the sample tube.

B. Dilution Techniques

Dilution techniques are applicable both to the inspector in his field observations and to the laboratory investigating team in providing for evaluation by odor panels.

For field use, either in odor patrol or in investigation of an odor incident, ambient air may be tested with the aid of a portable dilution device such as the "scentometer" (Figure 12-2). This device is actuated by inhalation by the operator, thus dispensing with pumps and electrical power sources; holes which can be opened or closed by the fingers permit precalibrated dilutions of the ambient air stream with air which is simultaneously deodorized by an activated charcoal filter. A useful feature is that the observer can combat the effects of olfactory fatigue by breathing only deodorized air for a period prior to an actual test.

Various devices, mainly constructed on similar principles, have been used for dilution of odorants for laboratory evaluation. However, the method of choice both for simplicity and accuracy appears to be the syringe technique. The odorous gas is displaced from the sample tube (for example, by mercury displacement) into a large graduated syringe, in which it is diluted by addition of odor-free air. Further dilutions are easily managed by the use of additional syringes, as illustrated in Figure 12-3. The last dilution, usually 10 to 1, is performed by the panelist, who is furnished with 10 ml of sample injected into his 100 ml syringe; he dilutes the sample to 100 ml with ambient air before sniffing it, and records a positive or negative result as to detection of the odor.

For confirming the identity of suspected odorants, or for quantitative determination of concentrations of identified odorants, gas chromatography can be performed, using samples no larger than those necessary for the organoleptic evaluation of odor.

Determining Sources Responsible for Odors

A. Odor Patrol

The possibilities of instituting quick, effective action to control odors when complaints arise depend, to a large extent, on the field officer's intimate knowledge of the odor potentials of the various industrial and other sources within the community. It is therefore necessary for him to become familiar with likely source activities.

A simple odor patrol is probably the best indicator of existing or potential nuisance from odorous discharges. This consists of a regular periodic patrol around selected plants or in selected areas, documented by notes as to observed odors, with time, location, and wind direction. Special patrols for complex industries such as refineries and chemical plants may be assigned to personnel specially trained for them, and cognizant of the particular activities which entail an odor potential. A record of such odor patrols is also useful in indicating where odor control efforts are most required.

B. Field Investigations of Odor Incidents

In a routine inspection of an industrial plant, the normal air pollution configuration is tracked from cause to effect – from the feed input of equipment to the effects of the contaminant generated from the equipment on receptors and the environment.

The tracing of an odor problem reported as a public nuisance is just the reverse of this procedure. The investigation begins with the complainant and his environment and works back to the equipment responsible in the following steps:

- Interview of complainants to obtain as much factual information as to the intensity, evidence and source of the contaminant.
- Identification of the contaminant causing the nuisance.
- Tracking the contaminant to its source or sources.
- Inspection of the equipment at the source to determine plant's capacity to emit the contaminant.
- Collecting signed district attorney affidavits or other official forms from complainants who desire to testify in court.
- Serving notices of violation to the source or motivating plant management to remedy the situation.

In an odor nuisance, the field officer must establish the existence of two areas: the effect area, that is, the area over which the nuisance effect exists; and the source area — that area which can be assumed by logical tracking techniques to contain the specific source or sources of the nuisance contaminant. The determination of a source area is often a first step in isolating the exact source and cause of the nuisance, especially in those cases where the specific source is difficult to establish initially.

1. *Odor Transport*

Odor Transport has several characteristics which should be recalled in field investigations.

- Odor flows downwind from source to receptor.
- Transport from a vent or chimney is in a plume. (Similar to a visible particulate plume.)
- Meteorology is favorable for transport with little dilution in the nighttime. (Prevalence of nocturnal inversions.)
- In unfavorable meteorology, odors travel long distances.
- Odors are dissipated by dilution, therefore may change from source to receptor.
- Odors per se leave no residual effects.

2. *Determining Air Flow from Source*

The basic problem in an odor nuisance is to establish the flow of air masses from a source of air pollution to establish responsibility, or to determine relative contributions to the problem from two or more sources. This pro-

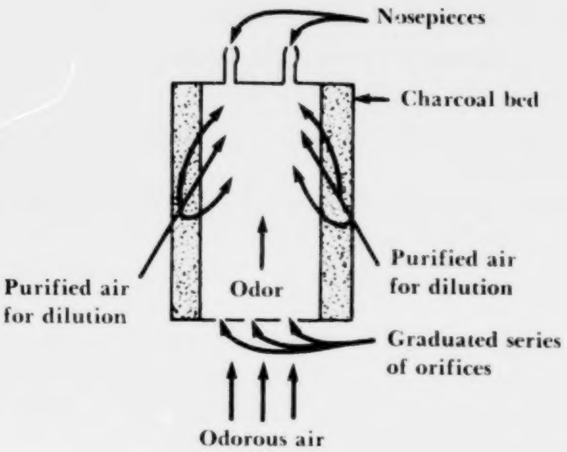

Nosepieces
Charcoal bed
Purified air for dilution
Odor
Purified air for dilution
Graduated series of orifices
Odorous air

Figure 12-2. Schematic of scentometer. Odorous air passes through graduated orifices and is mixed with air from the same source, which is purified by passing through charcoal beds. Dilution rates are fixed by the orifice selection. **(Reference 22)**

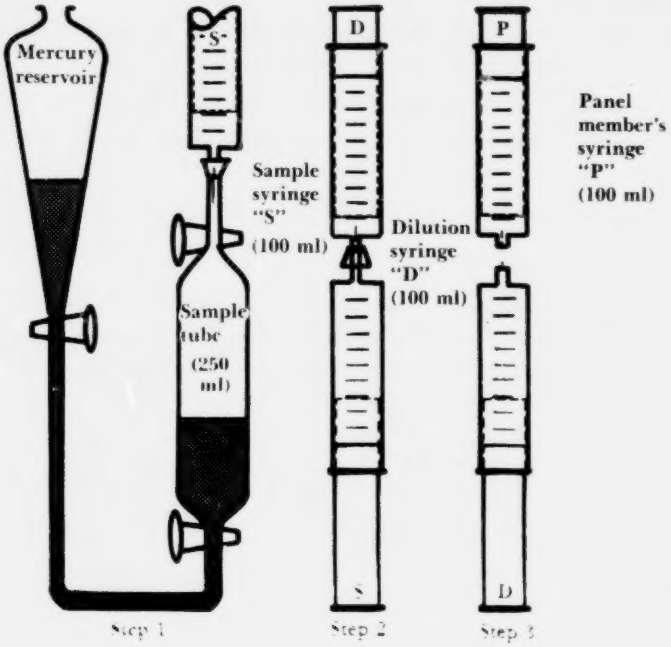

Mercury reservoir
S
Sample syringe "S" (100 ml)
Sample tube (250 ml)
D
Dilution syringe "D" (100 ml)
S
P
Panel member's syringe "P" (100 ml)
D
Step 1
Step 2
Step 3

Figure 12-3. Equipment used for transferring and diluting odor samples. (Source: Air Pollution
(Reference 7)

cedure is otherwise known as source tracking, and is especially applied when the source of the nuisance is originally unknown. This basically involves determination of wind direction and velocity for the purpose of triangulating the source.

In source triangulation, only two vectors are required, i.e., wind directions taken on separate occasions and locations at times of nuisance occurrence. Wind direction is always ascertained from the direction in which it is blowing. (A south wind blows from the south.) Wind direction can be determined from flags, steam or smoke plumes, finger-wetting, or a small hand held instrument available from most instrument companies.

The interview with the complainant should also attempt to establish the wind direction at the time of contamination. The investigator should instruct complainants and/or observers in recurring problems to maintain a record of time, intensity and wind direction. If this is not possible, the investigator should attempt to estimate the time the contamination is likely to occur, so that he can logically schedule reinspections.

In complex cases involving heavily industrialized communities with many possible sources, or where contamination or nuisance does not appear to be localized according to wind direction, the inspector may plot a wind rose, based on local meteorological data. A check with the enforcement agency may disclose prevailing wind patterns and other pertinent micrometeorological data for the area in question.

3. *Insitu Wind Vector Measurement*

A conclusive determination of air flow movement may be made by making in-situ wind vector measurements. Such observations can be made day or night.

The procedure involves the release of a small balloon inflated to about six inches diameter with helium from a portable tank carried at all times by the FEO. The release takes place from a position approximately on the center line of the odor plume, downwind from the source. The balloon is released and its travel in the plume is traced by sighting with a hand held compass. By using a bright yellow color for the balloon, the tracing can be made at night with a six cell flashlight.

The wind vector is recorded and later plotted on the survey map. Odor observations are made downwind and upwind and such data, odor present or not present, is also plotted on the survey map. By repeating the tracing process with different wind directions, the source can be located by triangulations.

4. *Recording Odor Survey*

In complex cases, the following tracking results are recorded on a map as shown in Figure 12-4:

- Location of complainants and distances from possible sources.
- Plant source layout showing principal types of equipment which may be involved.

- The number of complaints, and frequency of complaints as well as the time of day,
- Observations by inspectors at various points to fill in any gaps in data,
- The tracked contaminant routes and vectors of triangulation,
- Wind roses or other indications of wind direction.

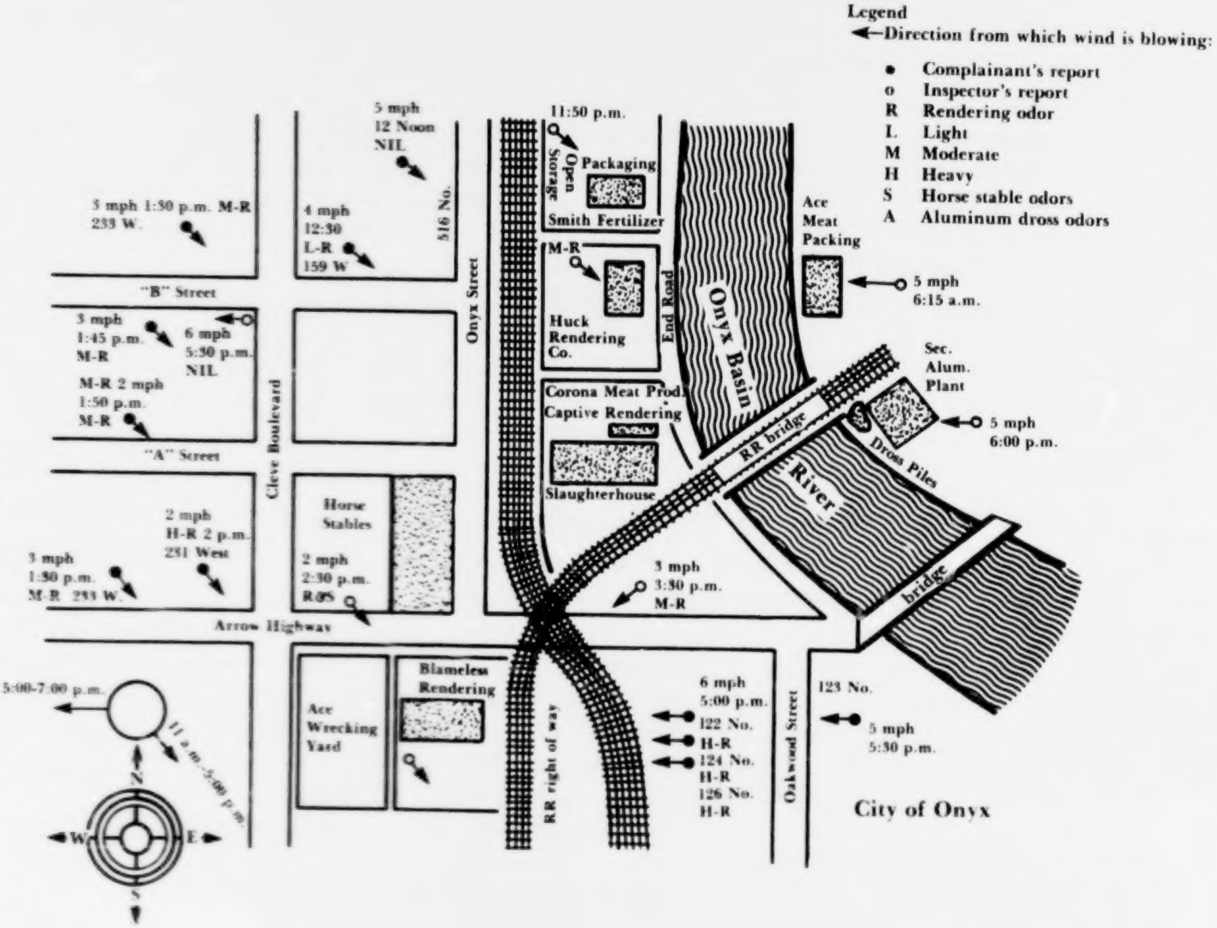

Legend
←Direction from which wind is blowing:
● Complainant's report
o Inspector's report
R Rendering odor
L Light
M Moderate
H Heavy
S Horse stable odors
A Aluminum dross odors
5 mph 12 Noon NIL
11:50 p.m.
Open Storage
Packaging
Smith Fertilizer
3 mph 1:30 p.m. M-R 233 W.
4 mph 12:30 L-R 159 W
516 No.
Onyx Street
M-R
Huck Rendering Co.
End Road
Onyx Basin
Ace Meat Packing
5 mph 6:15 a.m.
"B" Street
3 mph 1:45 p.m. M-R
6 mph 5:30 p.m. NIL
M-R 2 mph 1:50 p.m. M-R
Corona Meat Prod.
Captive Rendering
Slaughterhouse
RR bridge
River
Sec. Alum. Plant
Dross Piles
5 mph 6:00 p.m.
"A" Street
Cleve Boulevard
Horse Stables
2 mph H-R 2 p.m. 231 West
3 mph 1:30 p.m. M-R 233 W.
2 mph 2:30 p.m. R&S
3 mph 3:30 p.m. M-R
bridge
Arrow Highway
5:00-7:00 p.m.
11 a.m.-5:00 p.m.
N
W
E
S
Blameless Rendering
Ace Wrecking Yard
RR right of way
6 mph 5:00 p.m.
122 No. H-R
124 No. H-R
126 No. H-R
Oakwood Street
123 No.
5 mph 5:30 p.m.
City of Onyx

Figure 12-4. Odor survey. Although possibly malodorous industries are centered between Onyx St. and End Road and along the Onyx Basic River, reports and observations indicate that the Blameless Rendering Company is the primary source of the odors. This finding is verified by the fact that complaints are reported in two time periods—from 11:00 a.m. to 5:00 p.m., from residents north of Arrow Highway and west of Onyx Street, when the wind was from the southeast, and from 5:00 to 7:00 p.m., from residents in the area around Oakwood Street, south of Arrow Highway, when the wind was from the west. Inspection reports, operating data and point observations verify the existence of a public nuisance at the Blameless Rendering Company.

Relating Source Strength to Control Requirements

In correcting an odor problem, the contaminants responsible for an odor should be controlled so that threshold levels are never reached in the outdoor atmosphere of the community. Some industries incorrectly assume that they will have no odor problems, because they consider their own discharges to be unobjectionable or even pleasant. However, the presence of any odor which persists and is not normally associated with the daily routine of living will be a source of annoyance to the neighborhood. Complaint records show that this applies to such comparatively acceptable odors as those of baking bread and roasting coffee; therefore, it is wise to consider any odor as potentially objectionable.

The odor evaluations of source samples provide estimates of odor concentrations in terms of odor units per cubic foot which can serve as guidelines in the development of control methods. Thus, if a stack effluent is normally diluted by a factor of 1,000 before it arrives at a breathing level in the surrounding neighborhood, an odor concentration of 1,000 odor units per standard cubic foot could be considered to be on the verge of acceptability, while an odor concentration of 10,000 would require at least 90% control.

This sort of guideline can be refined by calculating an odor emission rate in odor units per minute. This is equal to the product of the odor concentration by the volume rate of the stack exhaust, in standard cubic feet per minute (scfm). Table 12-4 illustrates some examples of typical results using this approach (as reported by Benforado, et al.[26]

An application of odor measurement in improving neighborhood odors would be to survey all the operations in a plant and determine the odor emission rate from each. Listing such emissions together with estimates of costs for control can help management pick out the largest odor sources (rather than the largest stacks or largest volume discharges) and concentrate effort initially on those which are likely to provide the greatest improvement per dollar of expenditure.

Application	Exhaust Flow (scfm)	Average Odor Strength (odor units/scf)	Average Emission Rate (odor units/min)	Remarks
Rubber processing	6900	50	350,00	Acceptable controlled by direct flame fume incinerator
Coffee roaster	3600	2000	7,200,000	Not acceptable uncontrolled effluent from roasters
Rendering plant	29,000	1500-25,000	55,000,000 730,000,000	Not acceptable uncontrolled effluent from dryer

Table 12-4. Miscellaneous tests: rendering plant; coffee roaster; rubber processing plant.

Odor Control

The elimination of odors is the most important part of any odor problem. Air contaminants responsible for an odor should be controlled so that threshold concentrations are never reached in the outdoor atmosphere. This is accomplished by adopting any one of a combination of control devices or techniques such as waste gas incinerators, catalytic oxidation, and adsorption in activated carbon. Such common-sense control methods as general sanitation, refrigeration of animal tissue, improved maintenance and operational techniques should also be applied where odors arise from plant housekeeping.

The abatement of odors is accomplished either by complete destruction of odorants and prevention of odorant emissions, or neutralizing the malodorous effects of contaminants. Odor prevention or odor destruction is generally preferable since air pollution control in critical pollution areas seeks control of contaminants, not the effects of contaminants. For this reason, the ideal odor control method is perfect combustion. This is accomplished by an afterburner or waste gas incinerator. To be effective, such devices must maintain complete combustion at proper temperatures and exposure times, reducing all contaminants to odorless water and carbon dioxide. Partial or incomplete combustion may result in a series of reactive secondary products which may not only be malodorous, but eye-irritating and corrosive as well.

Other methods of preventing the escape of odors to the atmosphere include chemical scrubbing and charcoal filtering described in other sections of this manual.

Chapter 13

Emission Control Hardware Inspection Technique

EMISSION CONTROL HARDWARE

Goal

To familiarize the student with the air pollution source system; the various classes of emission control hardware; the physical appearance of control hardware; operating parameters related to effective collection; and the potential for failure along with indicators of such failure.

Objectives

At the end of this lesson, the student should be able to:

1. Name the six elements of the source system,
2. Recognize various types of control hardware by the outward appearance,
3. Define one operating parameter which indicates the effectiveness of separation for each type of control equipment,
4. Recognize instrument indicators and physical signs which indicate when control equipment is not functioning effectively.

Selected Reading

Reference 6, APTD-1101 — Control Technology and General Source Inspection Chapter 5.

EMISSION CONTROL HARDWARE

Introduction

A source of air pollution may also be defined as a source system. A source system, then, is a variety of things, such as a motor vehicle, an airplane, commercial process, an industrial process, or a combustion process such as a boiler or incinerator.

The source system begins with an area of contaminant generation and continues through duct work and various components until the gas stream discharges through a vent or stack to the outdoor air. Each element of the source system influences the selection of the control process, the first cost and the operating cost of the control equipment. Too often, in analyzing the needs of a non-conforming source, all attention is paid to the control device only, neglecting potential savings by ignoring an inadequate system.

Elements of the Source System

The functioning units of the system are:

- System entrance (point of contaminant generation)
- Transport (duct work)
- Air mover (fan)
- Instrumentation (controls and monitors)
- Sub-systems (contaminant removal and feed materials)
- Air pollution control devices

Figure 13-1 shows a combustion system where the combustion chamber of the boiler is the system entrance. Control of the system entrance is by controlling the firing devices, that is the fuel burner and the forced draft fan to satisfy the combustion air requirements. From the outlet of the boiler, the gases with their contaminant load pass through a duct system in which controls regulate the flow. The gases then progress usually to an air pollution control device, through an induced draft fan and finally to a chimney. Monitoring is installed. In addition to the firing subsystem, the ash handling may be a subsystem which also requires complete control. The ash handling system would be typical of an industrial process

Figure 13-2 shows a typical industrial process in which the system entrance is a series of hoods over operations which are a source of contamination. The conveying gases, usually air with the pollutant load progresses through ducts, past control dampers to a control device, then from the control device to the air mover, and finally out to the atmosphere through a vent or stack. Operating control and monitoring devices are needed. The contaminant removal arrangement is a subsystem and must be reckoned with.

Figure 13-2 shows make-up air. Often huge quantities of conveying air are necessary if the hood system is extensive. This air is discharged to the atmosphere and must be "made up" into the working space. Often make-up air is forgotten and the interior of the building is under a strong negative pressure.

The contaminant removal subsystem may require extensive treatment to condition the contaminant for its final resting place.

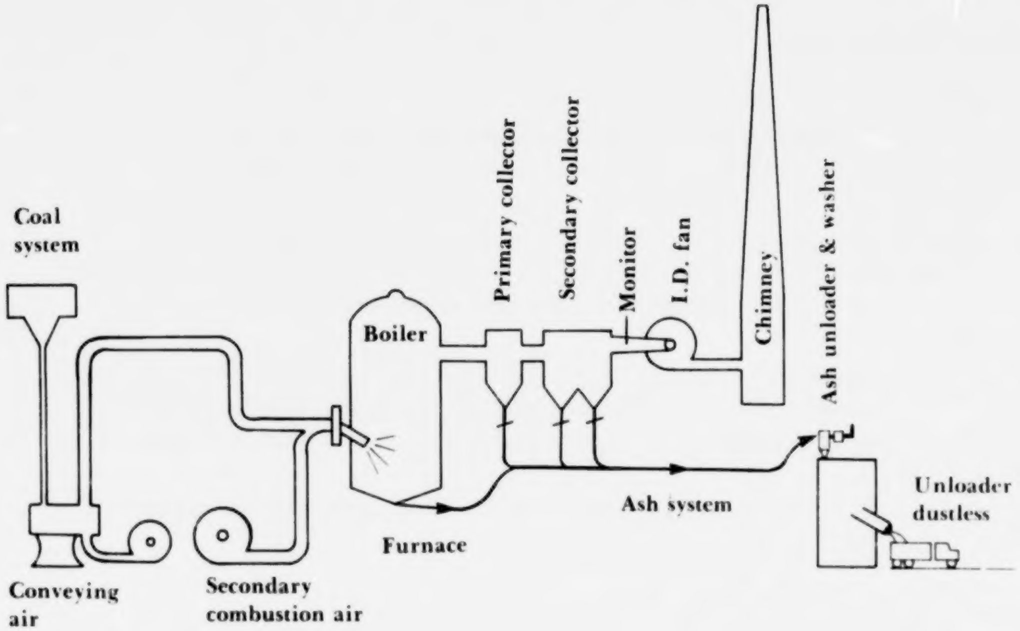

Coal system
Boiler
Primary collector
Secondary collector
Monitor
I.D. fan
Chimney
Ash unloader & washer
Unloader dustless
Ash system
Furnace
Conveying air
Secondary combustion air

Figure 13-1. Combustion source—system configuration.

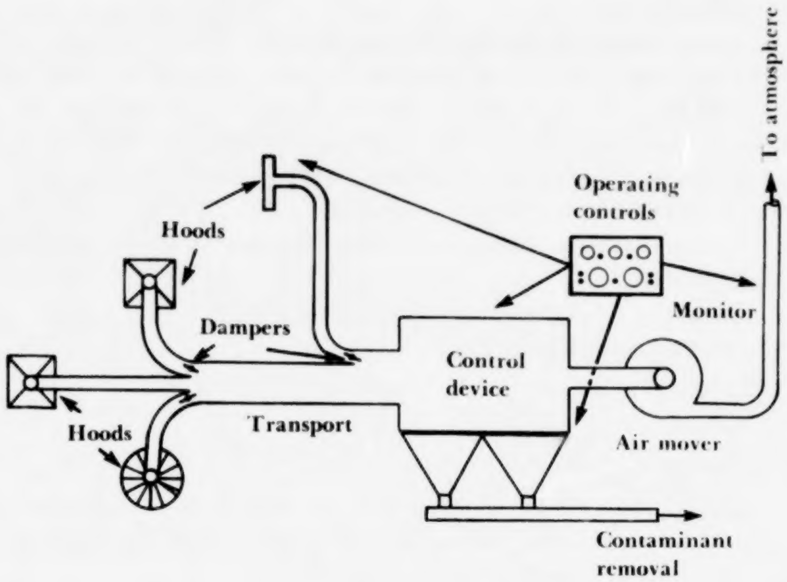

To atmosphere
Operating controls
Hoods
Monitor
Dampers
Control device
Hoods
Transport
Air mover
Contaminant removal

Figure 13-2. Source system configuration—industrial process.

SYSTEM COMPONENTS

A. System Entrance

While the system entrance can be many things, a reaction vessel, a furnace, etc., this section will deal only with hood design of the typical industrial system.

The design objective is to effectively capture the contaminant being released from the source with a minimum of volumetric air flow into the hood and a minimum of pressure loss on entry. Optimization of both air flow and pressure loss reduces fan horsepower and operating costs and the control device cost.

Inspection Points

1. Visible dust or vapors spilling from around the hood face while the system is operating is evidence of poor design or deficiency in volume flow due to a number of causes, as undersized fan, poor duct design or failure of dampers.
2. The duct connection at the hood should be checked to see that the connection is in place.

B. Transport (Duct System)

The duct system transports the gas (usually air) from the hood or the system entrance throughout to the discharge point. The design objective is to select the duct sizes to provide the minimum conveying velocities and then the fittings and configurations to reduce friction and turbulence losses.

1. ***Inspection Points***

   The order of inspection is usually from the process, the point of contaminant generation or the hoods, to the control equipment. As the FEO walks, he should look for:

   - Leaks in the duct work caused by warping, cracking, or buckling due to excessive temperature, deterioration from corrosion, lack of expansion joints or just poor workmanship;
   - Possible block at elbows, dampers or other fittings due to inertial separation of large particles;
   - Possible blockage due to settling of large particles in long straight runs with low conveying velocities;
   - Damper arms disconnected or not working.

C. The Air Mover (usually a fan)

The air mover can be a fan, a high hot chimney, or other form of exhauster which creates movement of air within the system. Because a fan is used in a high percentage of installations, discussion will be confined to the fan.

The purpose of the fan is to move the air through the duct system from the system entrance to the discharge point. To do this, the fan must overcome the friction loss in the duct system, the control devices, the entrance loss at the hoods and have enough static pressure to accelerate the air from zero velocity to the velocity in the duct and must be sized to the proper volume flow.

A proper fan is as important to the functioning of the system as the right collector. Too often the fan, as a source of trouble, is neglected.

The fan may be positioned upstream or downstream of the control device. A downstream fan position creates a negative pressure at the control device, drawing air in through cracks and openings, thereby minimizing leakage of the contaminant into the working area. Inleakage may diminish the required capture velocity at the source, allowing emissions into the work area. The reverse is true where the fan is located upstream of the control device, creating a positive pressure at the control device, permitting dust and other contaminants to escape into the work area through cracks or holes in the casing or duct connections.

Important parameters are fan speed (rpm) and fan horsepower. For a given fan wheel, change in air volume varies directly with the changes in rpm. Change in horsepower varies as the cube of the volume of air handled and, therefore, with the cube of changes in fan rpm.

$$\frac{Q_1}{Q_2} = \frac{RPM_1}{RPM_2} \quad \text{and} \quad \frac{HP_1}{HP_2} = \left(\frac{Q_1}{Q_2}\right)^3 = \left(\frac{RPM_1}{RPM_2}\right)^3$$

Inspection Points

- Check fan rpm and compare with permit data. If the fan speed is too high, the motor may be overloaded. If it is too low, the air volume is below design requirements.

  Measuring rpm is often not possible, so measure motor amperes as an indication of motor horsepower. Often, the panel board has an indicating ammeter for this purpose.
- Listen or feel the fan casing for signs of imbalance due to loose blades or dirt buildup on fan blades.
- Check for signs of deterioration as: excessive temperature coloring the metal; cracked casing; cracked or loose fitting duct connectors; or other signs of failure.

D. Instrumentation

Operating controls are important to the functioning of the system, and do not specifically relate to the air pollution control phase of the source system. Monitoring on the other hand is important and more attention is being directed toward monitoring. The Clean Air Act specifically requires monitoring devices for new major sources. Lesson 18, Source Emission Evaluation includes discussion on monitoring instruments.

Inspection Points for Operating Control

Look for obvious signs of failure or controls disconnected. The significance of instruments related to the control device will be discussed with the various type of control equipment.

E. Subsystems

Subsystems are processes in themselves, needed to convey the contaminant to its final disposal site or to feed materials into the process. Such process is often deficient in preventing escape of contaminant, especially dusts and odors. Subsystems include:

- Dry particulate removal and disposal.
- Dry feed materials systems.
- Sludge from wet systems.
- Contaminated liquids from absorbers and scrubbers.
- Regeneration of adsorbing solids in an adsorber.
- Catalyst regeneration.
- Gas conditioning device, such as an evaporative cooler, cold air bleed-in, or heat exchanger.

1. *Inspection Points*

a. Systems for dry feed material and disposal of dry collected dust should be checked for the following:

- Transfer points without enclosures or hoods not collecting,
- Leaks through bucket elevator conveyor housing,
- Dust from conveyors,
- Fugitive dust off storage piles,
- Mechanical transfer of dry dusty materials by front end loaders and bucket cranes,
- Roadway and driveway dust,
- Inadequate dust control on pneumatic conveyors,
- Failure of dust control devices on the conveyor system,
- Dust from gravity unloading of hopper to open truck.

b. Wet Systems

Wet systems are usually no problem unless the contaminant is smelly. An odor problem may arise from settling ponds, holding tanks and trucks.

c. Gas Conditioner

Look for: (a) evaporative coolers, where excessive water is being carried over into collector; (b) bleed-in systems with dampers inoperative; (c) heat exchangers with cracks or failures of metal components and (d) in all systems, failure of controls and inadequate instrumentation.

2. *Disposal of Collected Contaminant*

Question the ultimate disposal site or method. Four methods of final disposal are available. Do not let the collected contaminant cause trouble. You are never free of potential trouble until the separated contaminant is

- properly land-filled
- sold as a usable product
- returned to the process
- converted into a noncontaminant as in combustion or absorption.

Classification of Air Pollution Control Devices

All control devices function to accomplish one of the following:

a. Separate the contaminants from the gas stream within the collector and then remove it without re-intrainment, either continuously or intermittently, to the disposal system,

b. Change the contaminant from offensive to inoffensive as in combustion or scrubbing, or

c. A combination of a. and b.

Control devices can be classified according to the contaminants to be removed: i.e., for particulates only; for particulates and/or gases and vapors; for gases only; or for vapors only.

A. Particulates (also known as dry collectors)

1. Gravity settling chambers and inertial separators
2. Centrifugal separators (cyclones-multicyclones)
3. Fabric filters (bag filter, baghouse)
4. Electrostatic precipitator (ESP)

B. Particulates and Gases and Vapors

1. Wet collectors (scrubbers)
2. Combustion (afterburners, fume incinerators)

C. Gases

1. Absorption towers
2. Adsorption

D. Vapors

1. Condensing

Gravity Settling Chambers and Inertial Separators

Gravity separation and dry inertial collectors are unimportant as control devices because they are ineffective in separating all but the giant particles. They are seldom used separately, but may be seen occasionally as a preseparator ahead of a more efficient collector. Gravity separation may occur in duct work to cause plugging when inadequate conveying velocities are provided. Because of their relative unimportance and limitation of time, no further discussion of these collectors will be given.

Centrifugal Separators (Cyclones, Multicyclones)

A device or structure without moving parts in which (by the configuration of the structure) the velocity of an inlet gas stream is transformed into a confined vortex from which centrifugal forces tend to drive the entrained particles to the wall of the structure or body of the cyclone. See Figure 13-3. The separated particulates fall by gravity along the wall of the cyclone body into a hopper from which they are removed through a discharge valve.

A. Physical Appearance

Cyclones can be used singly (Figure 13-4) or nested in a housing called multicyclones (Figure 13-5).

Single cyclones are generally characterized as high efficiency or high throughput. High efficiency cyclones have a narrow inlet opening to attain high inlet velocity, long body length relative to body diameter and a small outlet diameter relative to body diameter (C5, Figure 13-4). High throughput cyclones have larger inlet openings and larger gas exits (C7, Figure 13-4).

Multicyclones, also called multiclones, or mechanical collectors (Figure 13-5) have numerous small diameter cyclone tubes in parallel inside a housing. Each tube is mounted into a header which separates the clean side from the dirty side of the gas flow. Because of the close nesting of the multiple tubes (at times up to 200 in a single unit), inspection of the tubes for wear failure is difficult.

B. Parameters Related to Efficiency

The pressure drop (Δp) across the collector is a strong indicator of separation efficiency. The FEO should have access to the design Δp prior to inspection.

Cyclones are very sensitive to particle size with very poor efficiency on submicron particles. Therefore, cyclones have difficulty in meeting opacity regulations where submicron particles are present in quantity.

C. Inspection Points

1. Check pressure drop across collector. If Δp is too low, the collection efficiency is reduced. If Δp is too high, excessive re-intrainment may take place. For a given cyclone, Δp varies as the square of the volume flow and directly as the gas density.
2. Leakage through hopper bottom unloading valve is very harmful. Back flow destroys the vortex.
3. Holes in cyclone body or hopper due to corrosion or wear. Result, same as 2., above.
4. Hopper does not unload when valve is opened. When hopper fills, all collected particulates are discharged out the stack.
5. Plugging inlet duct. This condition is indicated by reduced volume flow in duct system.

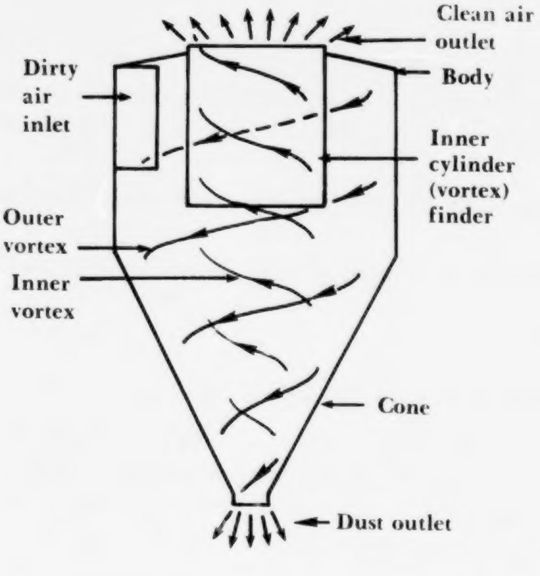

Clean air outlet
Dirty air inlet
Body
Inner cylinder (vortex) finder
Outer vortex
Inner vortex
Cone
Dust outlet

Figure 13-3. Simple cyclone.

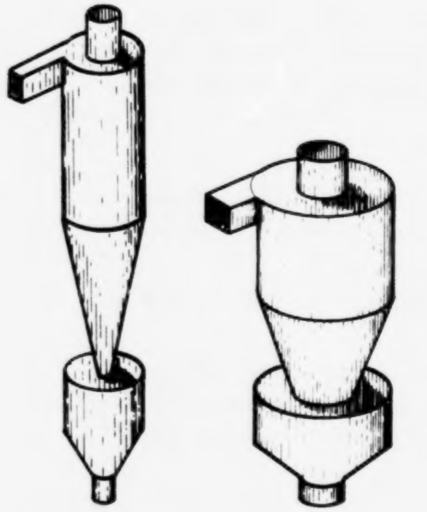

High efficiency
High throughput

Figure 13-4. Typical single cyclone collectors.

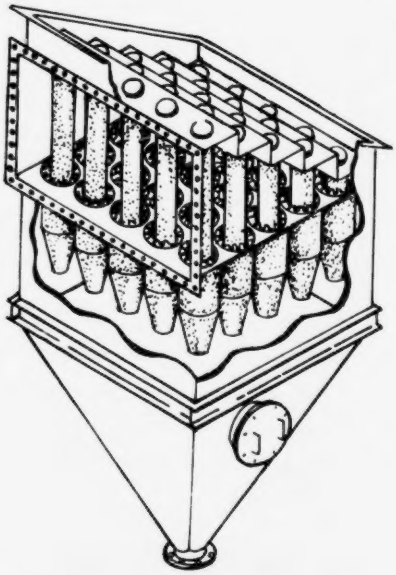


Figure 13-5. Multicyclone.

6. Condensation due to high humidity aggravates 4. and 5.
7. Interior parts deteriorated due to corrosion and wear. Indication is failure to collect giant particles. Look for fallout near outlet of collector or citizen complaint.
   - Single cyclone — the outlet duct extension corrodes away causing gas short circuiting.
   - Multicyclone — individual tubes plug or wear causing functional failure of the tube.
8. Visibility of outlet gases.

Fabric Filter (also known as bag filter or baghouse)

Filtration is the process of removing dusts and fumes by passing the gas stream through a porous media. Such forces as impaction, impingement, diffusion, gravity settling, electrostatic charge, and direct sieving (most important) are used to separate the particulates from the gas stream.

A. Physical Appearance

Most often a rectangular sheet metal box, set on a hopper, often insulated, ranging in size from the small 100 cfm units (Figure 13-6) about the size of a refrigerator packing box, to a very large unit handling 2,000,000 cfm which would fill one-half of a football field (Similar to Figure 13-7).

The interior arrangement varies widely, accommodation design of the filter media and operation, but externally they are as described above. Occasionally, a designer creates a bag filter with a cylindrical exterior which may look very much like a cyclone.

B. Separating Forces

The fabric filter has a two stage separating mechanism: (a) the building of the filter cake, and (b) the sieving through the cake. The fabric is used primarily to support the cake.

1. Building the cake results from impaction impingement, natural electrostatic forces and Brownian movement.
2. After the cake is established, the separating mechanism is direct sieving, which is the most important mechanism, resulting in high removal efficiency regardless of particle size. The finer the particles, the finer the cake (sieve) becomes.

C. Operating Characteristics

Fabric filters are usually rated by the ratio of gas (CFM) to the area of the filter (square feet) which is the velocity of the gas through the filter cloth. This parameter is called the air to cloth ratio or just filter ratio. A rule of thumb is a ratio of 1.5 to 3.0 CFM per square foot of cloth for dust and 1 to 2 CFM per square foot of cloth for fumes for a shaker type of cleaning. Pulse jet cleaning and special designs may go to 10 CFM per square foot of cloth or higher (see Table 13-1).

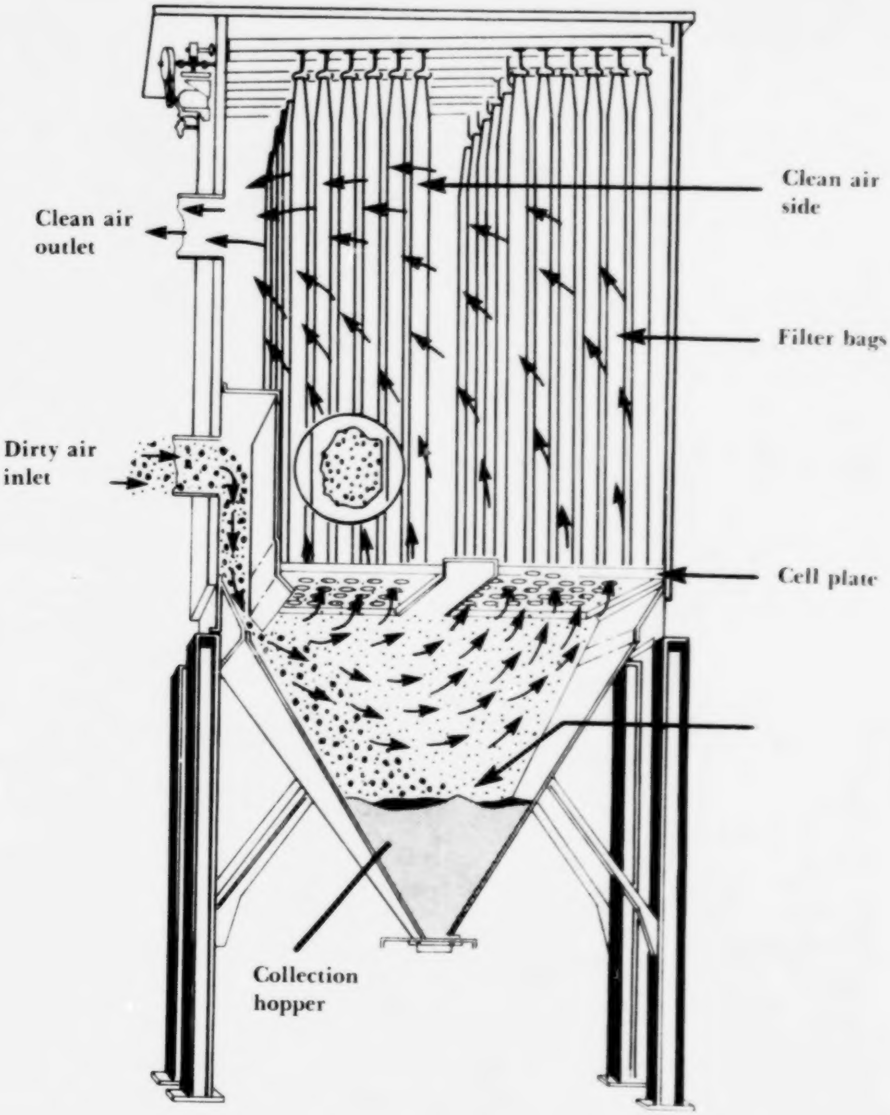

Clean air side
Clean air outlet
Filter bags
Dirty air inlet
Cell plate
Collection hopper

Figure 13-6. Typical simple fabric filter baghouse design.

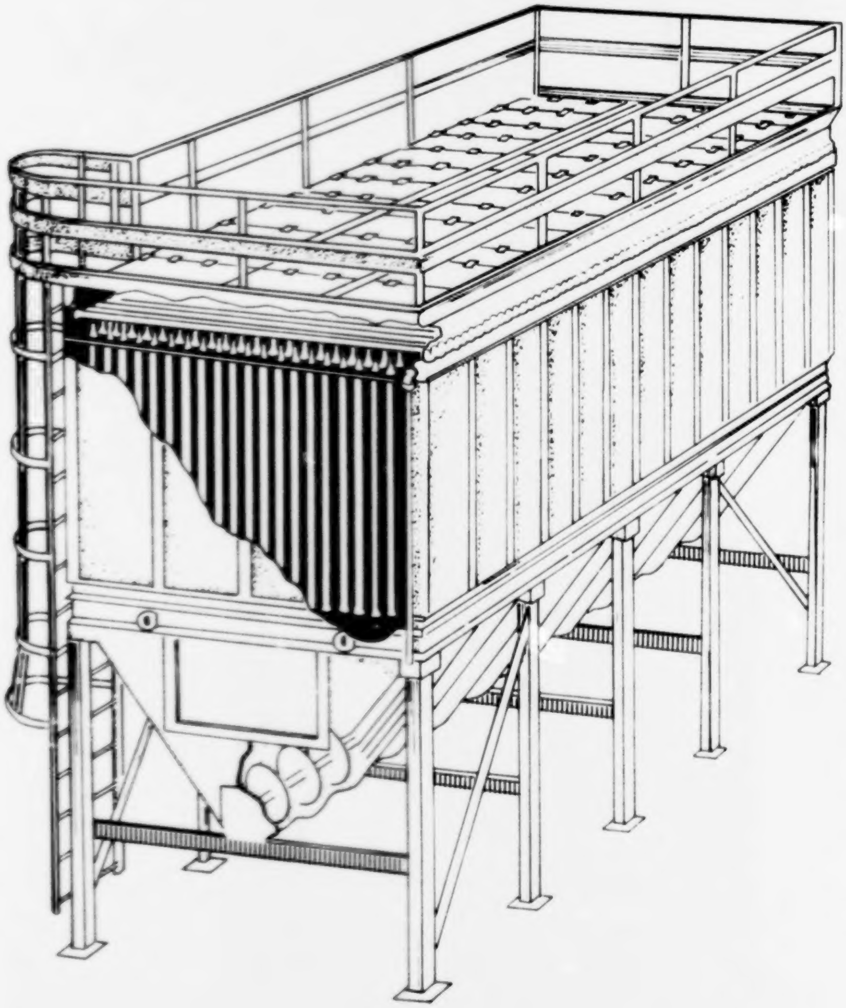


Figure 13-7. Typical pulse-jet baghouse with screw conveyor dust removal system.

Dust	Usual Air-Cloth Ratio (CFM/Sq. Ft.)		
	Shaker Collector	Pulse Jet	Reverse Air Collapse
Alumina	2.5-3.0	8-10	—
Asbestos	3.0-3.5	10-12	—
Bauxite	2.5-3.2	8-10	—
Carbon black	1.5-2.0	5-6	1.1-1.5
Coal	2.5-3.0	8-10	—
Cocoa, chocolate	2.8-3.2	12-15	—
*Clay	2.5-3.2	9-10	1.5-2.0
*Cement	2.0-3.0	8-10	1.2-1.5
Cosmetics	1.5-2.0	10-12	—
Enamel frit	2.5-3.0	9-10	1.5-20
Feeds, grain	3.5-5.0	14-15	—
Feldspar	2.2-2.8	9-10	—
Fertilizer	3.0-3.5	8-9	1.8-2.0
Flour	3.0-3.5	12-15	—
Graphite	2.0-2.5	5-6	1.5-2.0
Gypsum	2.0-2.5	10-12	1.8-2.0
Iron ore	3.0-3.5	11-12	—
*Iron oxide	2.5-3.0	7-8	1.5-2.0
Iron sulfate	2.0-2.5	6-8	1.5-2.0
Lead oxide	2.0-2.5	6-8	1.5-1.8

Dust	Usual Air-Cloth Ratio (CFM/Sq. Ft.)		
	Shaker Collector	Pulse Jet	Reverse Air Collapse
Leather dust	3.5-4.0	12-15	
Lime	2.5-3.0	10-12	1.6-2.0
Limestone	2.7-3.3	8-10	
Mica	2.7-3.3	9-11	1.8-2.0
Paint pigments	2.5-3.0	7-8	2.0-2.2
Paper	3.5-4.0	10-12	
Plastics	2.5-3.0	7-9	
Quartz	2.8-3.2	9-11	
Rock dust	3.0-3.5	9-10	
Sand	2.5-3.0	10-12	
Sawdust (wood)	3.5-4.0	12-15	
Silica	2.3-2.8	7-9	1.2-1.5
Slate	3.5-4.0	12-14	
*Soap, detergents	2.0-2.5	5-6	1.2-1.5
Spices	2.7-3.3	10-12	
Starch	3.0-3.5	8-9	
Sugar	2.0-2.5	7-10	
Talc	2.5-3.0	10-12	
Tobacco	3.5-4.0	13-15	
Zinc oxide	2.0-2.5	5-6	1.5-1.8

Note: Values tabulated are based on light to moderate loadings of granular dust having particle size and shape characteristics typical of the specific material. Ratios will normally be less when dust loading is very heavy, temperature is elevated, or particle size is smaller than commonly encountered.

Table 13-1. Typical air to cloth ratios.

1. The temperature and moisture content of the gases to be cleaned are important factors in the operation of baghouses. "Wet" gases will cause blinding (plugging) of the bags resulting in extremely high pressure drops which in turn will reduce the effectiveness of the entire collection system by reducing the volume of gases handled. The baghouse, therefore, should operate at a temperature above the dewpoint of the incoming gas.
2. Precooling equipment is a necessary part of most dust control systems using baghouses, where gases are at elevated temperatures. Three cooling methods are usually employed:

   a. Radiation and convection,

   b. Dilution air

   c. Spray cooling.

   Radiation and convection cooling systems need large cooling surfaces resulting in considerable space requirements. Spray cooling is not advised for gases with high moisture content. Where dilution air is used, it is necessary to increase the filter area to filter the cooling air. Where spray cooling can be used, controls must be included to keep the temperature of the gases 50°F to 75°F above the dewpoint.
3. Bag cleaning techniques vary. Figure 13-8 describes the most common cleaning mechanisms.

D. Inspection Points

A detailed list of all check points on a baghouse is beyond the scope of this course. Three important causes of baghouse failure are given. For more complete analysis of trouble shooting, see Table 5.13 of Reference 6.

1. ***Condition: High differential pressure***

   Most installations are designed for differential pressure of 3 to 4 in. A differential pressure of 1 in to 6 in can be considered normal.

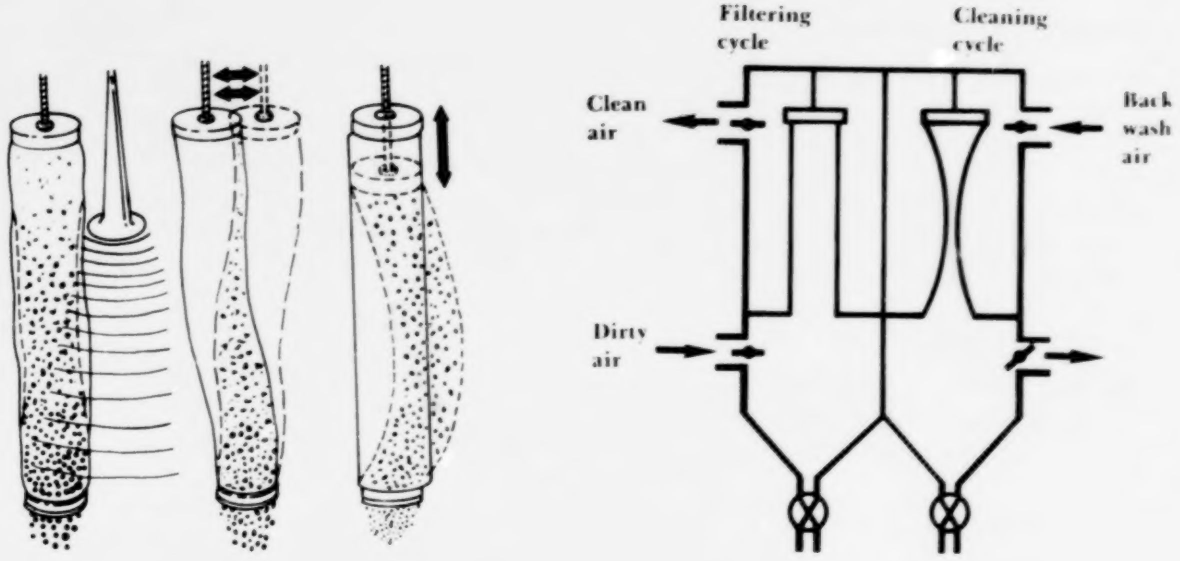
   High differential pressure is usually associated with failure of the bag cleaning mechanism to properly function. The analysis of the cause is quite complex and should be made by source owner.

2. ***Condition: Visible emission from stack outlet***

   This condition is generally caused by some form of bag failure, torn bags or loose seals, etc. Interior inspection must be made by the source owner to find cause and correct.

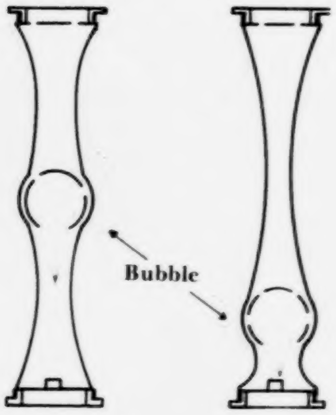
3. ***Condition: Insufficient suction on exhaust hood or system***

   Reduced volume flow is indicated. The cause could be at the fan, failure of bag cleaning, leaking duct work or clogged ducts.


Filtering cycle
Cleaning cycle
Clean air
Back wash air
Dirty air

Shaking

Reverse air



Bubble-jet/pressure-jet

Figure 13-8. Typical cleaning mechanisms

Electrostatic Precipitators

Electrostatic precipitation is a process in which particulates (solid and liquid) are removed from a gas stream by the action of electrostatic forces. As the gas passes between a pair of collecting plates, a corona discharge from a wirelike electrode at high voltage potential charges the particles and they move to electrically grounded collecting plates of opposite potential. See Figure 13-9.

The discharge electrode may be placed inside a tubular collecting surface, the configuration usually used in a wet precipitator. Figure 13-9.

A. Physical Appearance

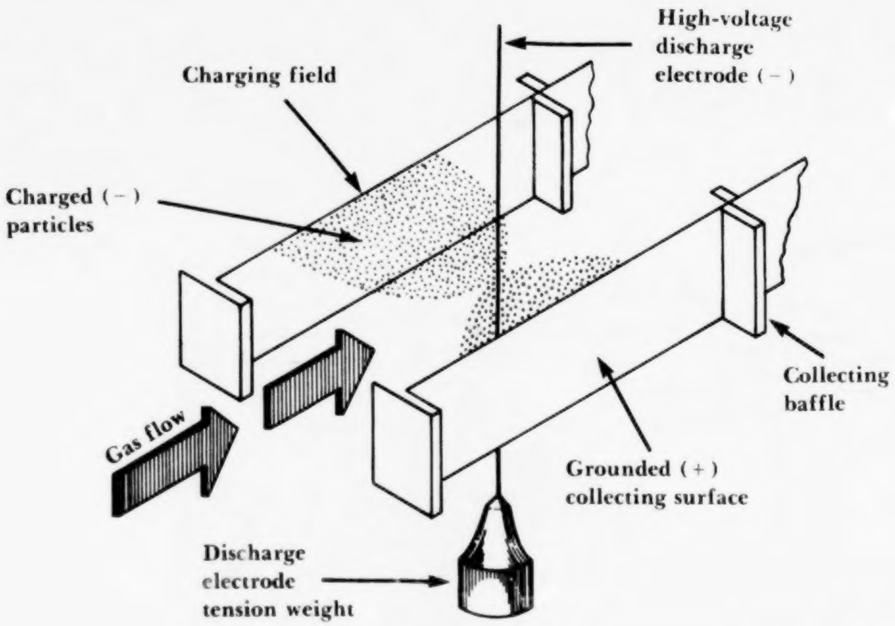
The ESP looks very much like a baghouse, i.e., a huge cube with hoppers beneath except that the ESP is distinguished by the rapping mechanism and transformer-rectifier sets mounted on top of the housing. Figure 13-10.

B. Operating Characteristics

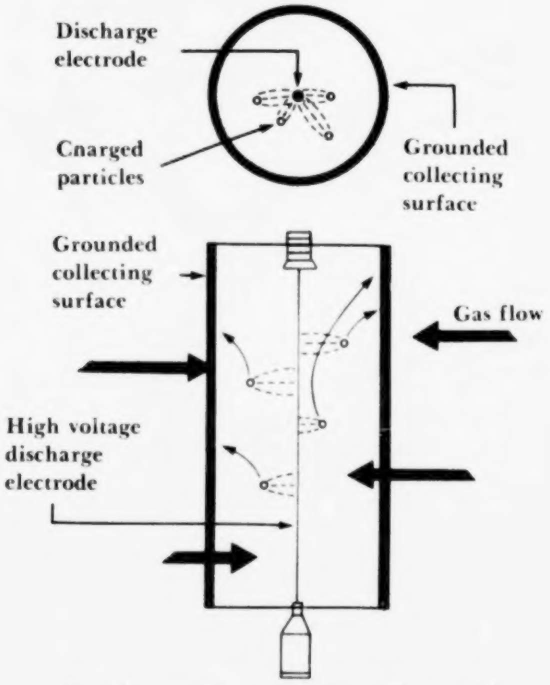
Electrostatic precipitators employ the principle of attraction of opposite charges. The particles in the contaminated exhaust stream are charged in a high voltage electric field and are then attracted to a grounded plate of the opposite charge where they are collected and slowly lose their opposite charge. When the plate is vibrated or rapped, the contaminants drop into a hopper.

There are two basic types of electrostatic precipitators. Single-stage precipitators operating at high voltage, 30 to 100 KV peak voltage, and 2-stage, low-voltage precipitators operating to 12 to 13 KV. The higher voltage precipitator is commonly used in large installations such as coal-burning central power stations and Portland cement plants. The low-voltage, 2-stage precipitators are used to control mists and other particulates from smokehouses, asphalt paper (see Figure 13-12).

Direct current is used, being supplied by transformer-rectifier sets, each set supplying a part of the ESP. Efficiency of collection is usually highest when the voltage is highest. Peak performance is indicated by the beginning of the sparking from wires to plate and the sparking rate is sometimes used as a control. Plates are generally rapped by mechanisms mounted on top of the housing or, in some designs, mounted on side of the plates. In large modern units, the wires may also be rapped for cleaning.


High-voltage discharge electrode (–)
Charging field
Charged (–) particles
Gas flow
Collecting baffle
Grounded (+) collecting surface
Discharge electrode tension weight

Flat surface-type electrostatic precipitator


Discharge electrode
Cnarged particles
Grounded collecting surface
Grounded collecting surface
Gas flow
High voltage discharge electrode

Tubular surface-type electrostatic precipitator

Figure 13-9. Electrostatic precipitators.

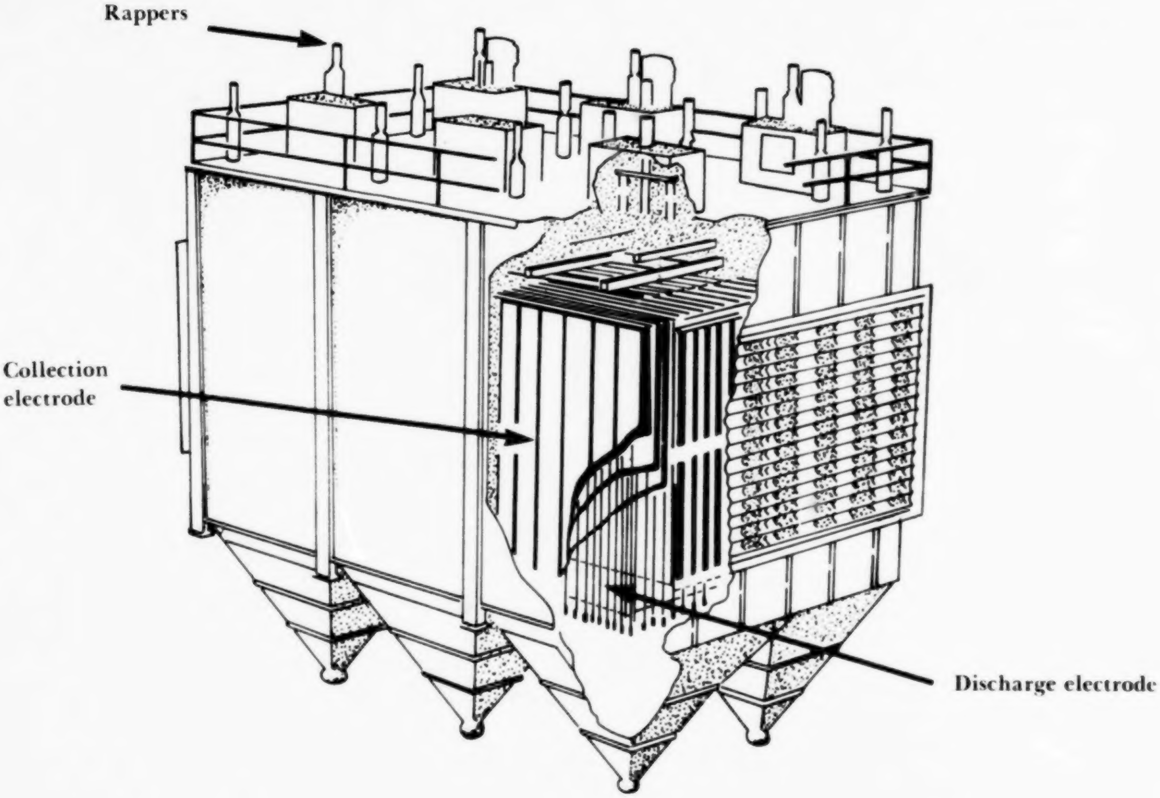

Rappers
Collection electrode
Discharge electrode

Figure 13-10. Electrostatic precipitator.

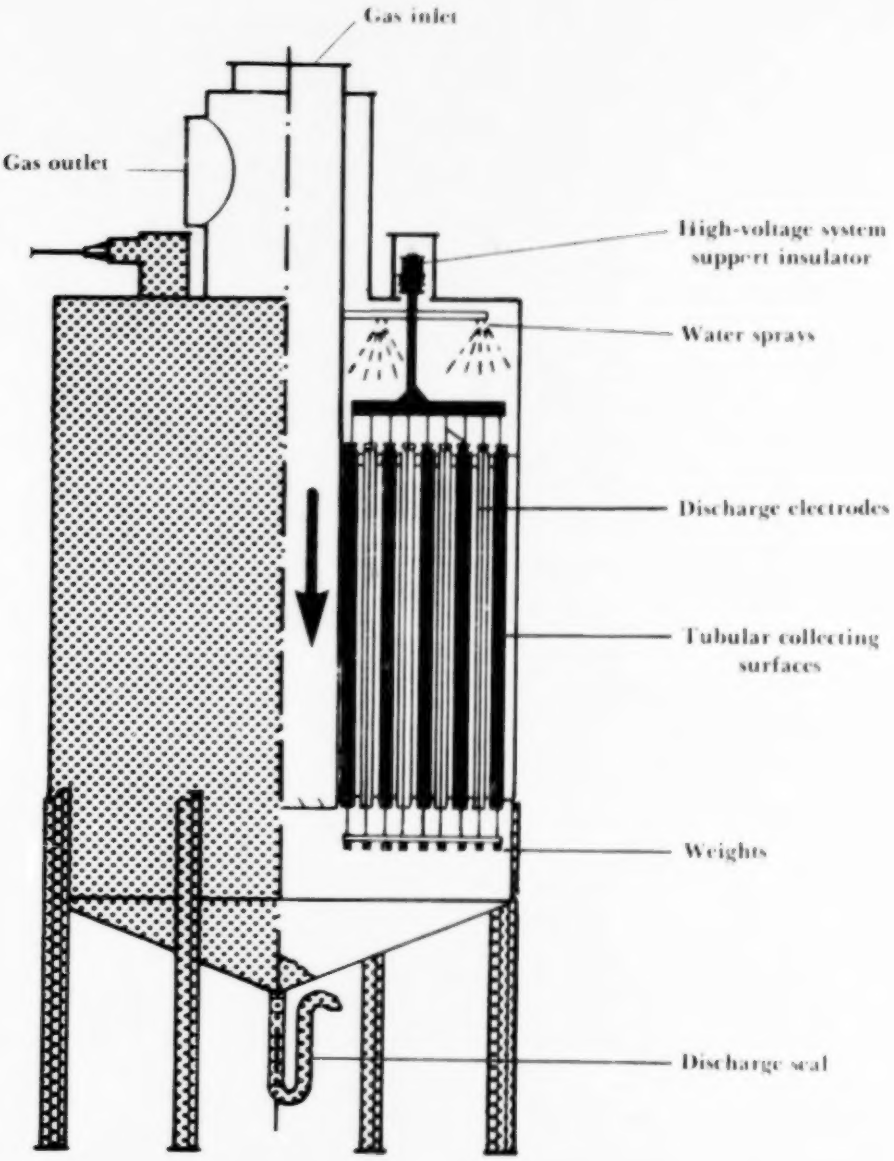

Gas inlet
Gas outlet
High-voltage system support insulator
Water sprays
Discharge electrodes
Tubular collecting surfaces
Weights
Discharge seal

Figure 13-11. Irrigated tubular blast furnace precipitator.

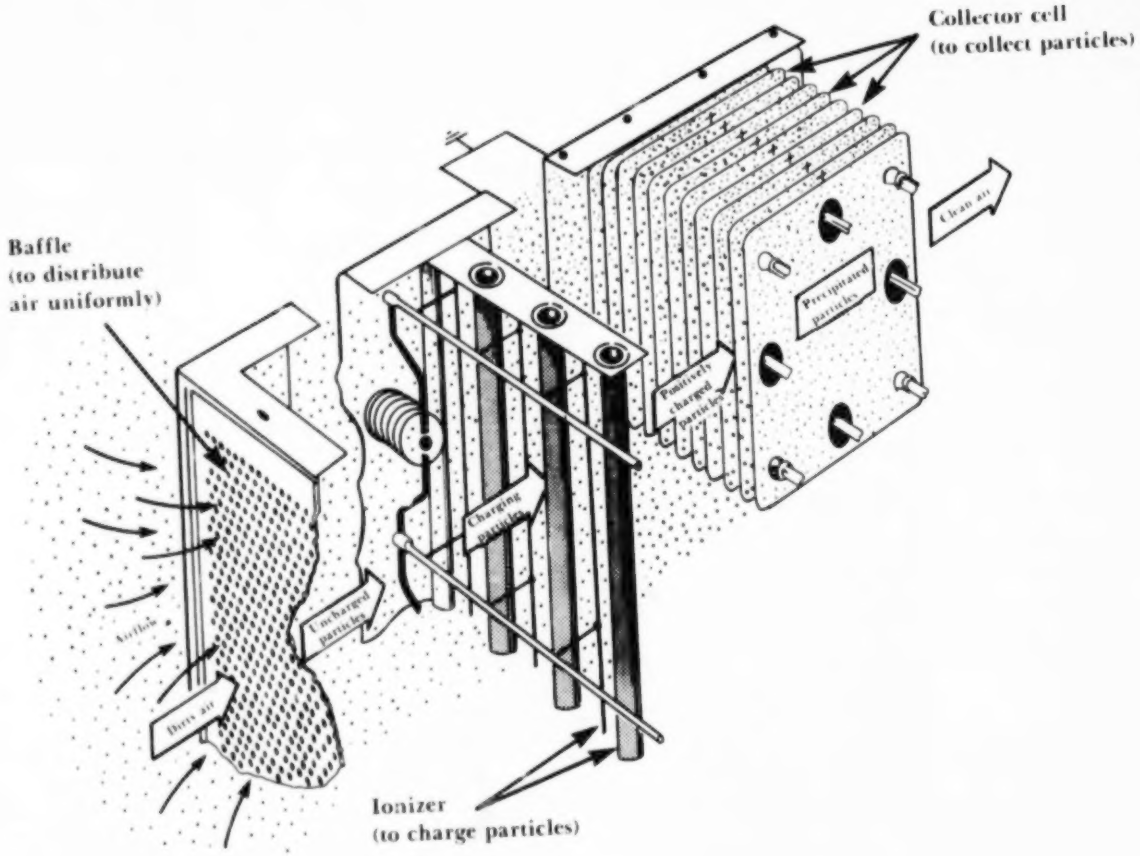

Collector cell
(to collect particles)
Clean air
Precipitated particles
Positively charged particles
Baffle
(to distribute
air uniformly)
Charging particles
Uncharged particles
Airflow
Dirty air
Ionizer
(to charge particles)

Figure 13-12. Components of standard two-stage precipitator. *Westinghouse Electric Corporation*, Hyde Park, Boston, Massachusetts.

C. Major Inspection Points

The FEO should confine his inspection to several major indicators. Visibility of the outlet gases is perhaps the most telltale inspection point, particularly where visibility has increased from previous inspections. There are innumerable conditions which could result in increased visibility, due to fall-off in fine particle collection efficiency, some of which could be checked as:

- Rectifier output voltage (usually kilovolts) and current (usually in milliamperes). Check against design conditions.
- Sparking rate in sparks per minute. Sparking rate indicates maximum voltage being utilized. Sparking rate meters are not common, but they may be found on newer installations.
- Maintenance logs to determine adequacy of interior inspection, particularly for broken discharge wires.
- Check for change in process or materials, such as ash characteristics of fuels.

When deviations are noted, the FEO should avoid comment on the consequences of such deviation and especially specific recommendations. Many interdependent conditions affect ESP performance.

Wet Collectors (Scrubbers)

This section will deal with wet collectors, whose separation mechanism is impaction of the particulates on liquid droplets or wetted targets. The almost endless variety of wet collectors makes it difficult to include all types and varieties in this course.

Three types of scrubbers have been selected for discussion in this unit, namely centrifugal spray, venturi and flooded bed scrubber.

A. Physical Appearance

Centrifugal spray scrubber is shown in Figure 13-13; venturi scrubber is shown in Figure 13-15; and a flooded bed scrubber is shown in Figure 13-14.

B. Inspection Points

In addition to observing the color, opacity and carryover after the dissipation of water vapor from the scrubber, the enforcement officer must be aware of its operating characteristics and physical characteristics. Inspection points include:

1. Record the Δp and check against design.
2. Recording the water pressure to the scrubber to compare it with the design pressure. Lower than design Δp indicates a lowering of collection efficiency.
3. Noting impairment in efficiency due to freezing.
4. Check the maintenance schedule for cleaning and replacing nozzles.
5. Noting the operation of fans and pumps. Check for excessively worn drive belts.

6. Noting if the bypass system has been opened and the duration of the time of bypass.
7. Recording temperature and pressure of gases entering the scrubber to check against design parameters.
8. A check for structural wear from corrosion.

Combustion (Afterburner, Fume Incinerator)

(For gases and vapors.)

Combustion is the rapid oxidation of contaminant gases, vapors, and particulates to odorless, colorless and innocuous waste gases generally not considered to be contaminants. Principally applied to control organic compound emissions, the end products would be CO_2 and water vapor.

A. Physical Appearance

There are two types of combustion devices.

1. Direct or thermal units which are furnace-like in appearance with either gas or oil burning apparatus plainly visible (Figure 13-16).
2. Catalytic units have the appearance of a duct heater, generally made of sheet metal, rather higher instrumented (Figure 13-17).

B. Parameters Relating to Efficiency

In both thermal and catalytic units, the parameter indicating efficiency is the outlet temperature which is dictated by the characteristics of the contaminant to be oxidized. It is assumed that good mixing and proper retention time are designed into the unit. In thermal units, the minimum outlet temperature is considered to be 1200° F with certain substances requiring considerably higher temperatures.

Catalytic units are generally designed for a bed inlet temperature of 800-1000°F.

Permits should always state the temperature parameters for reference during inspections.

C. Inspection Points

Principally, the outlet temperature for thermal units or temperature rise for catalytic units.

Outlet visibility or odor emission should be checked.

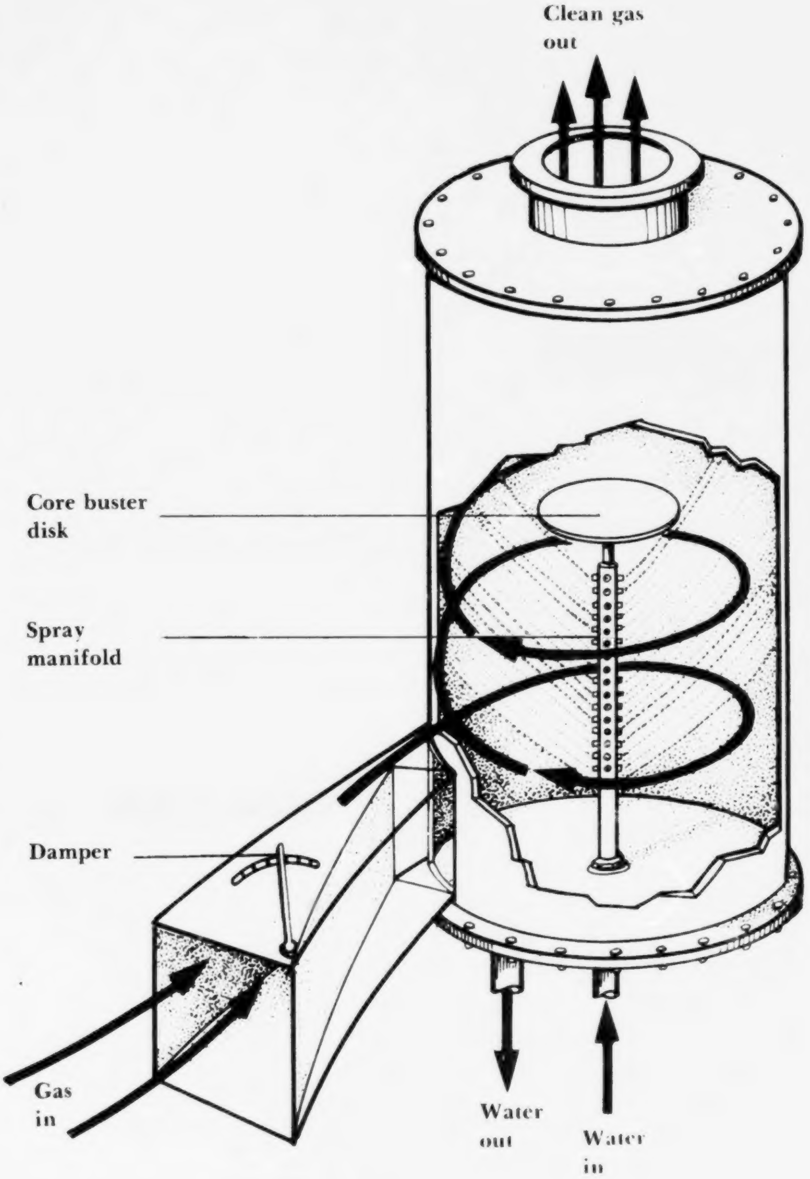

Clean gas out
Core buster disk
Spray manifold
Damper
Gas in
Water out
Water in

Figure 13-13. Centrifugal spray scrubber.

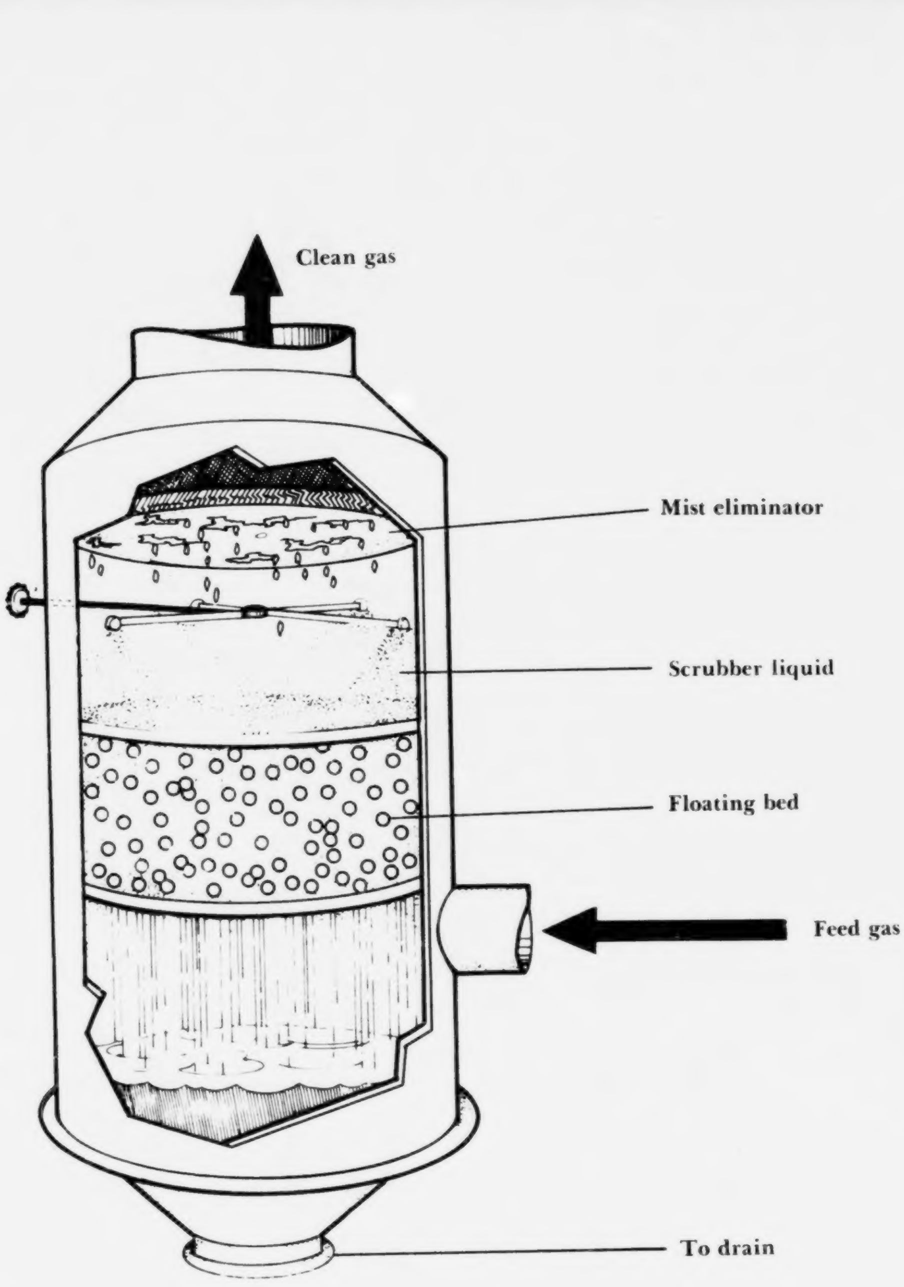

Clean gas
Mist eliminator
Scrubber liquid
Floating bed
Feed gas
To drain

Figure 13-14. Floating-ball (fluid-bed) packed scrubber.

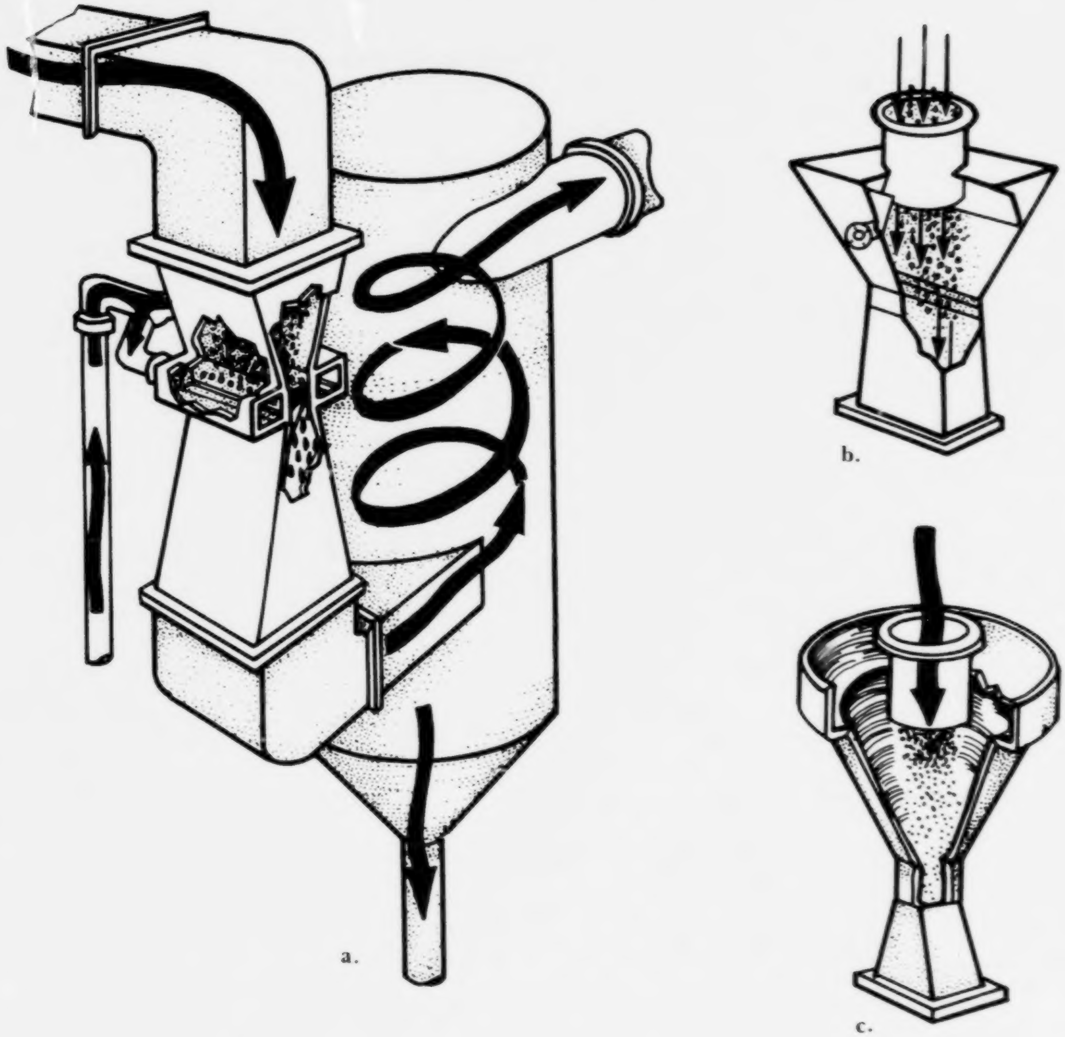


Figure 13-15. Venturi scrubber.

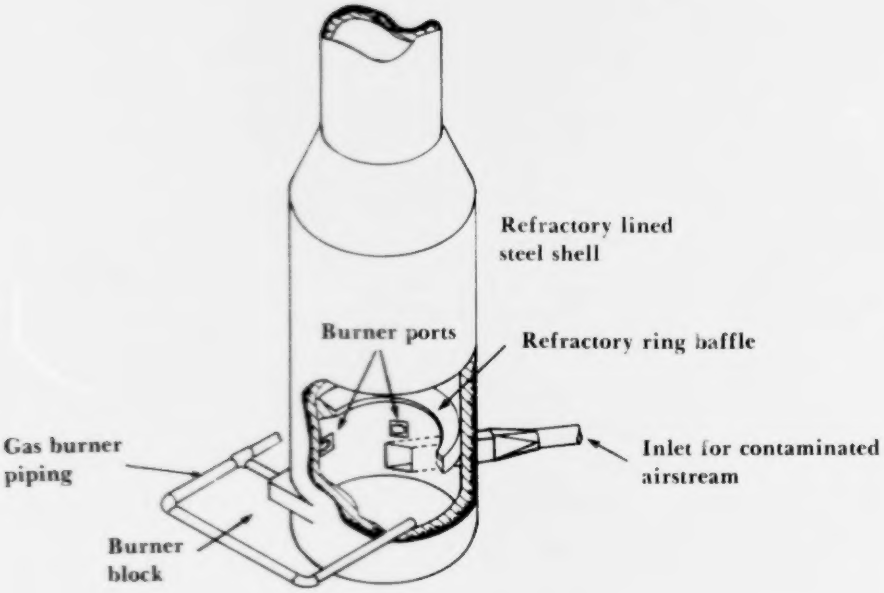

Refractory lined
steel shell
Burner ports
Refractory ring baffle
Gas burner
piping
Inlet for contaminated
airstream
Burner
block

Figure 13-16. Direct-fired afterburner with tangential entries for both the fuel and contaminated gases.

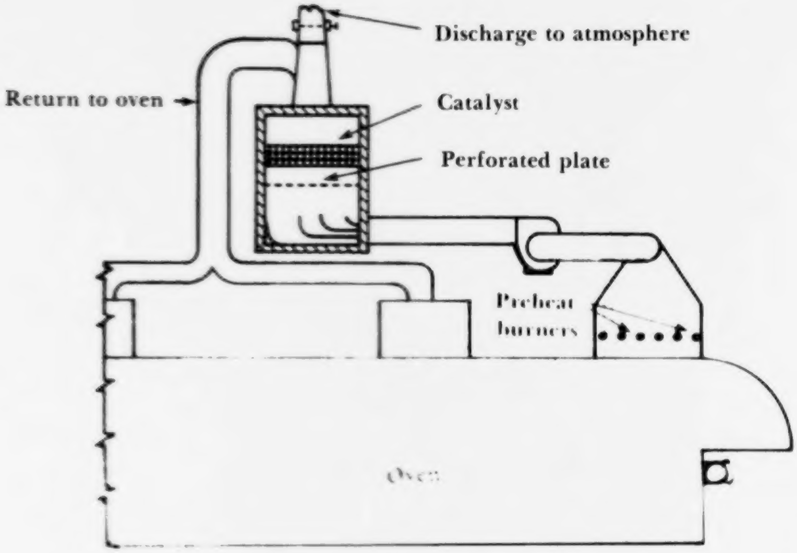

Discharge to atmosphere
Return to oven
Catalyst
Perforated plate
Preheat
burners
Oven

Figure 13-17. Catalytic afterburner utilizing direct heat recovery.

Absorption

(For gases and vapors.)

Absorption is the process of removing contaminants from a gas stream by causing them to dissolve in a liquid. Both gaseous and vapor contaminants may be separated by absorption methods. The effectiveness of the method for a particular contaminant depends upon the use of a liquid which is a specific solvent for that contaminant.

Absorption equipment can be either plate (bubble), spray, or packed towers, each type being designed to provide thorough contact between the gas and liquid phases. The rate of removal is largely dependent upon the amount of surface exposed. The necessary contact can be accomplished by dispersing gas in the liquid as the gas passes through the tower. In a packed tower (Figure 13-18), both gas and liquid phases are continuous.

A. Packed Towers

A packed tower is filled with small solid objects designed to expose a large surface area, which is kept wet by a continuous flow of the absorbent, over the packing as shown in Figure 13-19.

Usually the flow through a packed column is countercurrent, with the liquid introduced at the top to trickle down through the packing, while gas is introduced at the bottom to pass upward through the packing. This results in high efficiency, since, as the solute concentration in the gas stream decreases as it rises through the tower, there is constantly fresher solvent available at the top (gas outlet) of the tower for contact.

B. Inspection Points

Once a tower has been designed, the operating parameter that can be changed is the liquid flow rate and variability of the gases to be cleaned. In air pollution control applications, the packed tower is often used to remove odorous substances, so the carryover of odor is a good indicator and should be noted.

Other check points might be a change in the liquid/gas ratio, the temperature of the liquid and the plugging of the tower by particulates or other substances, causing excessive pressure drop and consequently reduced gas flow.

Adsorption

(For gases only.)

Adsorption is a process by which there is a mass transfer of the contaminant from a gas stream onto the surface of a highly porous solid, called an adsorbent. In the general case, an adsorption process is usually followed by a regeneration process, in which the activity of the adsorbent is restored by driving the adsorbate (the contaminant) out of the bed, with or without recovery of the adsorbate

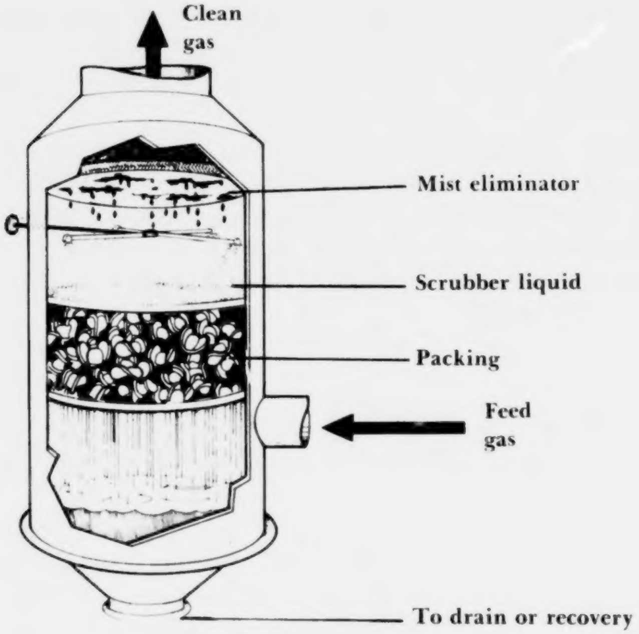

Clean gas
Mist eliminator
Scrubber liquid
Packing
Feed gas
To drain or recovery

Figure 13-18. Packed tower.

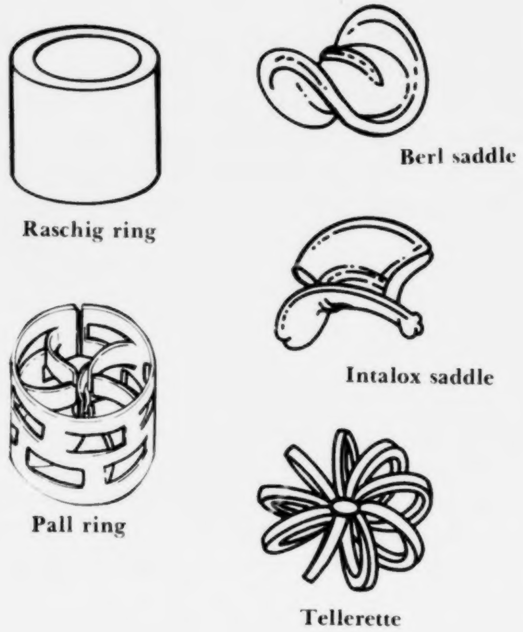

Berl saddle
Raschig ring
Intalox saddle
Pall ring
Tellerette

Figure 13-19. Common tower packing materials.

Activated charcoal is the adsorbent most suitable for removing organic vapors, as it affords practical control for all vapors of compounds having boiling temperatures above the temperature of melting ice. Even more volatile contaminants can be effectively adsorbed if the temperature of the adsorbent is lowered.

A. Physical Appearance

Usually a vessel for containing the adsorbing solid arranged: (a) in a cannister, (b) in a thin bed such as a filter, or (c) in a thick bed placed in a closed cylindrical vessel.

Thick bed units are often installed in parallel with piping and controls for automatic cyclic operation from adsorption to desorption modes, schematically in Figure 13-20.

B. Inspection of Adsorbers

An adsorber is a complex process and no definitive parameters, which can be instrumented, are available for surveillance. Since adsorbers are often used in odor control, inspection might be the observation of odor carryover from the stack. In many cases, economic recovery of solvents spurs the operator to maintaining efficiency. The only real measure of performance is an emission test performed by a trained stack test team.

Condensing

(For vapor recovery.)

Condensation is the process of removing a vaporous material from a gas stream by cooling it, thereby converting it into a liquid phase. In some instances, control of volatile contaminants can be satisfactorily achieved entirely by condensation. However, most applications require additional control methods. In such cases, the use of a condenser as part of the control system, or vapor recovery system, can confer such benefits as reducing the load on a more expensive control device.

A. Physical Appearance

Condensers are (See Figure 13-21):

- Surface condenser such as shell and tube, a cylindrical vessel, or
- Contact or barometric condensers where a direct spray contacts the gases which then discharge into a hot well.

Besides collecting condensable contaminants, condensers may materially reduce the volume of the contaminated gas streams. To a degree, contact condensers are also scrubbers. Probably their most common application is as auxiliary units in systems containing afterburners, absorbers, baghouses, or other control devices.

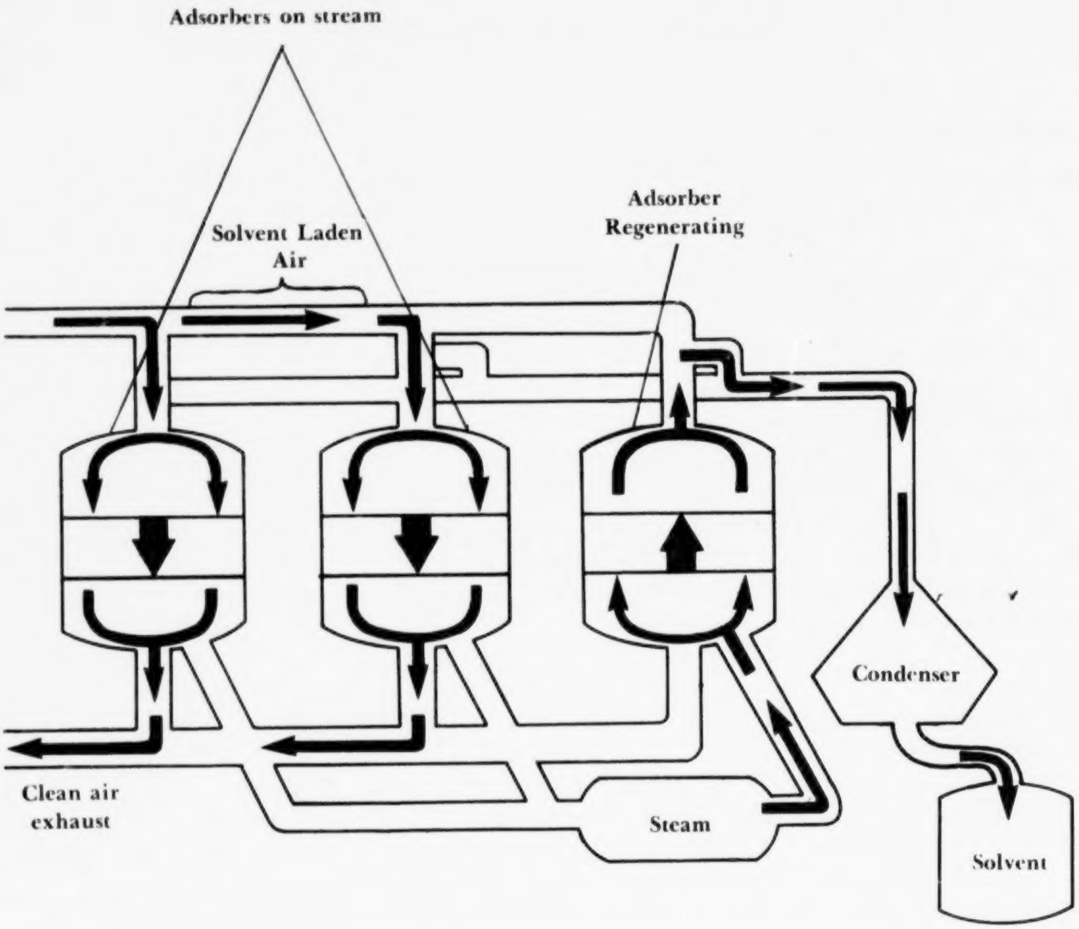

Adsorbers on stream
Solvent Laden Air
Adsorber Regenerating
Condenser
Clean air exhaust
Steam
Solvent

Figure 13-20. Typical Adsorber.

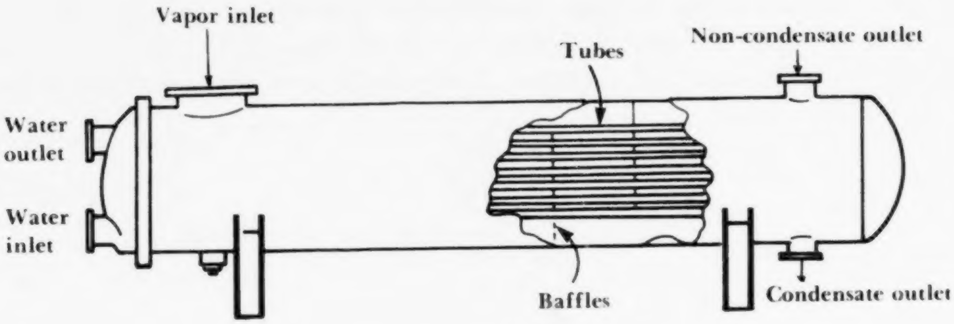
B. Inspection of Condensers

Condensers are used to abate odors or recover solvents from high temperature exhausts from drying processes.

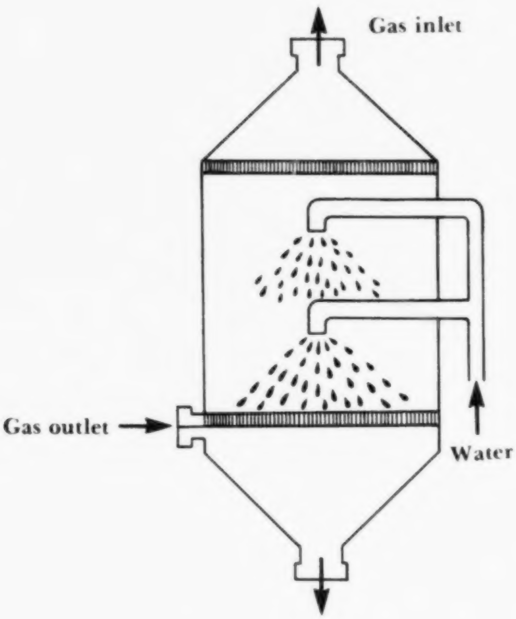
An important parameter is the temperature and flow rate of the condensing liquid.

Instrumentation would permit monitoring of such temperature and flow rates.

As in adsorption, a good surveillance technique is to monitor the odor from the stack. The only quantitative measure of compliance would be a source test.


Vapor inlet
Tubes
Non-condensate outlet
Water outlet
Water inlet
Baffles
Condensate outlet

Shell and tube condenser


Gas inlet
Gas outlet
Water

Spray type contact condenser

13-21. Condensers.

Chapter 14

Inspection of Combustion Sources

INSPECTION OF COMBUSTION SOURCES FILM AND WORKBOOK

Goal

To teach the principles of combustion as they relate to an inspection to be carried out by an experienced FEO.

Objectives

At the end of this lesson, the student should be able to:

1. Identify various important components of fuel burning systems, especially coal or oil,
2. Enumerate the inspection points and observations which should be made,
3. Explain the elements necessary for complete combustion,
4. Define air-fuel ratio,
5. Identify the instrumentation which relates to combustion control,
6. Identify the instruments which relate to monitoring of the combustion process and emissions therefrom.

Selected Reading

Reference 6, APTD-1101 – Volume II, Chapter 7, Sections I and II.

Reference 31, Enforcement Manual for NSPS, Fossil-Fuel Fired Steam Generators.

Reference 7, Air Pollution Engineering Manual, Chapter 8, Combustion Equipment.

INSPECTION OF COMBUSTION SOURCES FILM AND WORKBOOK

General

This lesson uses a specially written short program for study of combustion and then presents a film demonstrating the inspection by an FEO of three fossil-fuel fired steam generators:

Part I	Utility Boiler with Pulverized Fuel and ESP. A cyclone furnace is demonstrated.
Part II	Industrial Boiler Fired by a Spreader Stoker, Equipped with a Multi-Cyclone Collector.
Part III	Oil Fired Utility Boiler with no Collector.

Special Student Manual

A special manual for the students titled, "Inspection of Combustion Sources" and included in exercise 6 of your workbook contains two components: first, a general discussion of combustion and combustion equipment called the Workbook, and second, the film with an introduction and data forms to be filled out while viewing each part. An Instructor's Manual is supplied to the instructor containing the data forms as completed by the inspector in the film.

Student Workbook

The beginning parts of exercise 6 in the workbook are intended to be a self study manual on combustion practices. Because of the length of time that would be required to read and study the material, it cannot be used in this manner for this course. In its place, a thirty minute presentation of the principles of combustion, based on the workbook will be given by the instructor.

Chapter 15

Emergency and Alert Procedures

EMERGENCY AND ALERT PROCEDURES

AIR POLLUTION EPISODES

Goal

To describe the conditions which create emergency situations and the FEO response to such emergencies.

Objectives

At the end of this lesson, the student should be able to:

1. Differentiate between local emergencies and air pollution emergency episodes.
2. Explain the involvement of the FEO in local emergencies.
3. Give three examples of possible causes of local emergencies.
4. Name four stages of the episode plan structure.
5. Explain the type of inspections required of the FEO during emergency episodes.

EMERGENCY AND ALERT PROCEDURES AIR POLLUTION EPISODES

Introduction

Emergencies are of two types: (a) local emergencies, that is incidents involving the untoward release of contaminants that may be toxic or have the potential for other undesirable health or environmental effects; and (b) air pollution episodes in which the buildup of contaminants in the atmosphere approaches or exceeds predetermined levels and may necessitate the curtailment or shutdown of source activities on a large scale. These conditions require swift response on the part of enforcement officers and performance of special inspections.

Local Emergencies

Local emergencies may be observed during field patrol, may occur as a result of citizen complaints or result from reported breakdowns of equipment. Frequently, other governmental units such as fire and police will report emergency conditions and request assistance.

Examples of these emergencies include emergency dumping of ammonia from commercial refrigeration systems; explosions from a chlorine manufacturing plant; safety valves lifting; sudden failure of central device; refinery breakdowns and fires; the spread of noxious or malodorous gases; or radiation accidents.

Special emergency field sampling equipment that may be needed during local emergencies include explosimeters, geiger counters, test papers, tutweiler apparatus, midget impingers, gas absorption cells, halide leak detectors, sling psychrometers, and so on.

Description of the foregoing equipment and other on-the-spot testing can be found in the Field Operation and Enforcement Manual, Vol. I, (Reference 4, Chapter 4, Section VI, F.) The effective use of this equipment would generally be assigned to a technical services group, but in an emergency the FEO may be required to take samples. Interpretation of results of measurement is open to question and depends on the training of the sampling group.

The field enforcement officer's knowledge of the sources and the properties of the toxic gases that may be involved would be helpful. He should know whether potential hazards to life or health exist within the sources he is assigned for supervision. The benefit of a doubt should be given to the possibility of a hazard and appropriate assistance should be sought from health, fire or police authorities.

A full report of any incident should be made including any possible determination as to whether it was due to accidental or to deliberate causes. Industries which have a potential for posing hazards to health under accidental or abnormal conditions should be required to install and continuously maintain source monitors or otherwise provide for preventative measures.

Air Pollution Emergency Episodes

The State Implementation Plans must include episode contingency plans which, at a minimum, provide for preventing ambient pollutant concentrations from reaching levels which could cause significant harm to health of persons within the affected area.

Significant harm levels are set by EPA (40 CFR 51.16 (a)) as

SO_2 – 2,620 μ/m^3 (1.0 ppm), 24-hr. average

Particulate – 1000 μg/m^3 or 8 COH$_s$, 24-hr. average

$$\text{Product } (\text{TSP}\bullet SO_2) - \left.\begin{array}{l} 490\bullet 10^3(\mu g/m^3)^2 \\ 1.5\ \text{COH}_s\bullet \text{ppm} \end{array}\right\} \text{ 24-hour average}$$

O_3 – 1,200 μg/m^3 or 0.6 ppm 1-hr. average

CO – 57.5 mg/m^3 (50 ppm), 8-hr. average
86.3 mg/m^3 (75 ppm), 4-hr. average
114 mg/m^3 (125 ppm), 1-hr. average

NO_2 – 3,750 μg/m^3 (2.0 ppm), 1-hr. average
938 μg/m^3 (0.5 ppm), 24-hr. average

A. Episode Plan Requirements

The episode plan must contain:

- Episode criteria
- Surveillance system
- Emission reduction plan
- Communication system
- Legal authority

B. Episode Structure

A four-stage episode structure is generally adopted to meet the plan requirements. The stages, in order, are Forecast, Alert, Warning, Emergency.

Figure 15-1 shows the Air Pollution Episode Sequence suggested by 40 CFR 51.16 and Appendix L.

Response in Emergencies

Air pollution episodes, general or local, require out of the ordinary response by the entire agency and in particular by the FEO. In the local episode the FEO will usually be first at the scene especially if radio communication is available. Often, other units as fire, police or civil defense will also be there. The FEO surveys needs for technical help and calls for same or acts on his own knowledge depending upon the seriousness of the situation.

In the general air pollution emergency, more time is available because of the staged procedure. The FEO will have little responsibility for initiating any part of the plan but will function according to a preassigned set of tasks. The main thrust of the FEO would be to monitor the effectiveness of curtailment orders and act to bring sources into compliance with general orders or with the source by source emergency curtailment plan.

A most important part of the FEO training in preparation for his field assignment during an emergency is to establish a firm understanding of the enforcement policies when noncompliance and/or noncooperation is observed during the emergency. The agency cannot wait until the day of the emergency to decide on such enforcement policy.

In all curtailment plans, it is worthy to note that some sources may require many hours to shut down. Such time requirements must be provided for in the source curtailment plan.

FORECAST, ALERT, WARNING, EMERGENCY

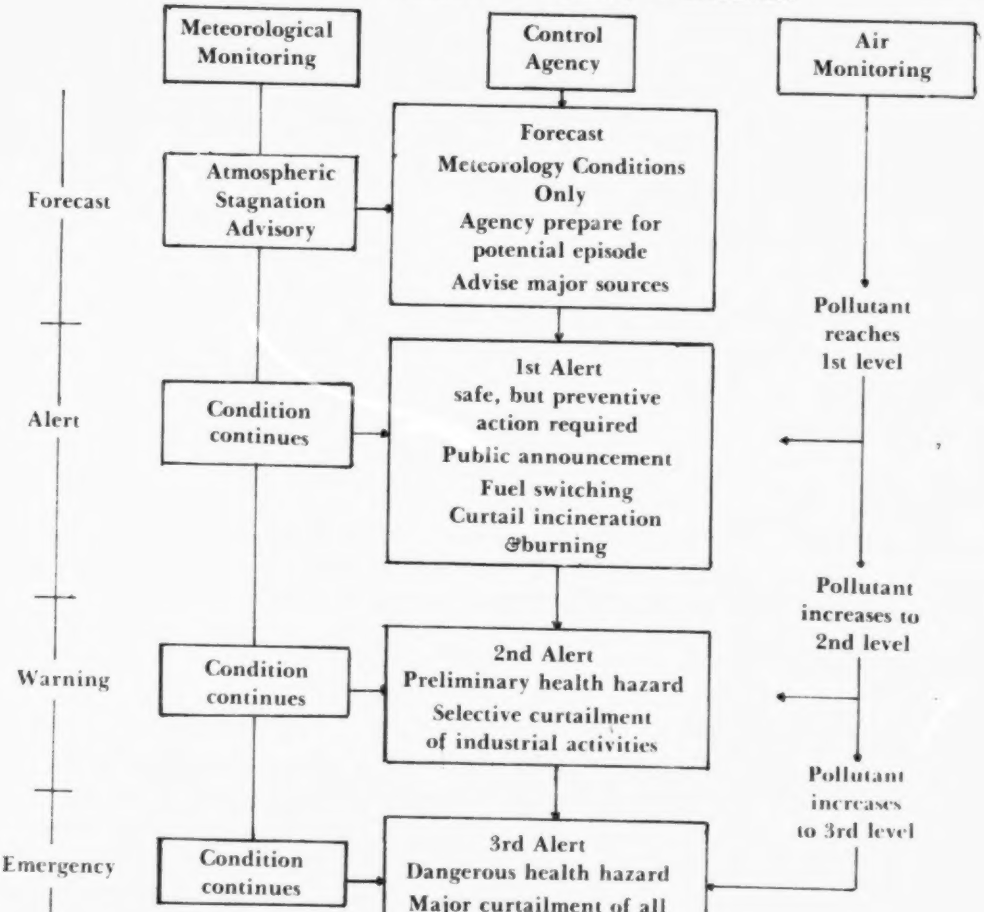

Meteorological Monitoring
Control Agency
Air Monitoring
Forecast
Atmospheric Stagnation Advisory
Forecast
Meteorology Conditions Only
Agency prepare for potential episode
Advise major sources
Pollutant reaches 1st level
Alert
Condition continues
1st Alert
safe, but preventive action required
Public announcement
Fuel switching
Curtail incineration &burning
Pollutant increases to 2nd level
Warning
Condition continues
2nd Alert
Preliminary health hazard
Selective curtailment of industrial activities
Pollutant increases to 3rd level
Emergency
Condition continues
3rd Alert
Dangerous health hazard
Major curtailment of all activities in community

Figure 15-1. Emergency episode, sequence procedure. "...To prevent ambient pollution concentrations from reaching levels which could cause significant harm to the health of persons..."

Summary

In summary, the FEO should prepare for emergency situations by learning, in advance, what he is expected to do, the curtailment requirements, source by source, and how he reacts to the nonconformist.

A. REFERENCES

1. The Federal Clean Air Act.
2. U.S. Government. *Code of Federal Regulations, Title 40, parts 50 to 59.* U.S. Government Printing Office, Washington, DC; 1978.
3. U.S. Government. *Code of Federal Regulations, Title 40, parts 60 to 99.* U.S. Government Printing Office, Washington, DC; 1978.
4. U.S. EPA, Office of Air Programs. *Field Operations and Enforcement Manual for Air Pollution Control, Volume I: Organization and Basic Procedures,* APTD-1100, Research Triangle Park, NC; 1972.
5. U.S. EPA, Office of Air Quality Planning and Standards. *Guidelines for Public Reporting of Daily Air Quality—Pollutant Standard Index (PSI),* EPA 450/2-76-013. Research Triangle Park, NC; 1976
6. U.S. EPA Office of Air Programs. *Field Operations and Enforcement Manual for Air Pollution Control, Volume II: Control Technology and General Source Inspection,* APTD-1101. Research Triangle Park, NC; 1972.
7. Danielson, J.A. *Air Pollution Engineering Manual, 999-AP-40, Second Edition.* EPA OAQPS; May 1973.
8. Air Pollution Training Institute. *EPA Course SI 422—Air Pollution Control Orientation Course.* Research Triangle Park, NC; 1979.
9. Knight, H. and Stevenson, W. *Communication for Justice Administration, Theory and Skills.* Cincinnati, OH: Anderson Publishing Co.; 1976.
10. U.S. EPA. *Inspection Manual for Enforcement of New Source Performance Standards, Portland Cement Plants,* EPA 340/1-75-001; 1975.
11. U.S. EPA. *EPA Standards of Performance for New Stationary Sources, Appendix A, Method 9.* Code of Federal Regulations, 40 part 60.
12. Gruber, C.W., and Jutze, G. *Air Pollution Effects Surveillance, Chapter 10, Volume III, Ed. 3 of Air Pollution,* A.C. Stern, Ed., New York: Academic Press; 1976.
13. Segal, A.H. *Criminal Actions,* ARB Enforcement Symposium, Sacramento, CA: Sept. 14-16, 1977.
14. U.S. EPA, Office of Air Quality Planning and Standards. *Diagnosing Vegetation Injury Caused by Air Pollution,* EPA-450/3-78-005 handbook. Research Triangle Park, NC: 1978.
15. U.S. EPA. *Guidelines for Evaluation of Visible Emissions, Certification, Field Procedures, Legal Aspects and Background Material,* EPA-340/1-75-007; April 1975.
16. EPA Air Pollution Training Institute. Course SI 448 *Diagnosing Vegetation Injury Caused by Air Pollution.* Research Triangle Park, NC; 1979.
17. Frye, R.P., *Notes for Overview of the Federal EPA in the Enforcement Program—with Emphasis on the Interface with State Enforcement,* EPA Course 444, Pittsburgh, PA; July 1978.
18. Gruber, C.W. *Notes from talks on the Federal Clean Air Act,* given by the following:
    - (a) Foster, K., Engineer, Division of Stationary Source Enforcement Course 444, Research Triangle Park, NC; Oct. 1978 and Jan. 1978.
    - (b) Walker, M.S., Senior Attorney/Hearing Officer, Enforcement Division, EPA Region IX, Course 444, Honolulu; August 1978.
    - (c) Sanderson, M. General Attorney, Enforcement Division, EPA Region VII, Course 444, St. Louis; May 1978.
    - (d) Phillips, C. Chief, General Enforcement Section, EPA Region VIII, Course 444, Denver; Feb. 1978.
19. Nader, J.S. *Current Techniques of Odor Measurement, Chemical-Toxicological Conference.* A.M.A. Archives of Industrial Health, Volume 17, No. 5; May 1978.

20. Crocker, E.C. and Henderson, C.F. *Analysis and Classification of Odors,* American Perfumer and Essential Oil Review 22:325; 1927.
21. McCord, C.P., and Witherridge, W.N. *Odors Physiology and Control.* New York; McGraw-Hill Book Co., Inc., 1949.
22. Phelps, A.H., "Odors," in *Air Pollution, Volume III, Edition 3 A.C. Stern (ed.).* New York City: Academic Press; 1976.
23. Turk, A. *Selection and Training of Judges for Sensory Evaluation of the Intensity and Character of Diesel Exhaust Odors.* DHEW, PHS, Pub. No. 999-AP-32; 1967.
24. Prince, R.G.H., and Ince, J.H. *The Measurement of Intensity of Odor.* J. Appl. Chem. 8: 314-321; 1958.
25. Leonardos, G., Kendall, D. and Barnard, N. *Odor Threshold Determinations of 53 Odorant Chemicals.* J. Air Pollution Control Association. Volume 19, No. 2; February 1969.
26. Benforado, D.M., Rotella, W.J., and Horton, D.L. *Development of Odor Control Equipment.* J. Air Pollution Control Association. Volume 19, No. 2; February 1969.
27. Gruber, C.W., Jutze, G.A., Huey, N.A., *Odor Determination Techniques for Air Pollution Control.* J. Air Pollution Control Association 10:327-330; 1960.
28. Feldstein, M., Story, T.E., and Mangat, T.S. *The Control of Odor by Emission Limitations,* APCA Paper 77-38.4 APCA Pittsburgh, PA; 1977.
29. Prokov, W.H., et al. *Developing Odor Control Regulations, Guidelines and Considerations.* J. Air Pollution Control Association. Volume 28, No.1., January 1978.
30. U.S. EPA. *Inspection Manual for Enforcement of New Source Performance Standards, Asphalt Concrete Plants;* 340/1-76-003. 1976.
31. U.S. EPA. *Inspection Manual for Enforcement of New Source Performance Standards, Fossil-Fuel Steam Generators,* 340/1-78-002; 1975.
32. U.S. EPA. *Industrial Guide for Air Pollution Control, EPA Handbook;* June 1978.
33. Air Pollution Training Institute. *Continuous Monitoring for Source Emissions.* EPA Training Course 474; April 1977.
34. Air Pollution Training Institute. *Source Sampling for Particulate Pollutants, Student Manual.* EPA Course 450.
35. U.S. EPA. *Resource Manual for Implementing the NSPS Continuous Monitoring Regulations, Manual 3—Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports,* 340/1-78-0050; 1978.
36. Steiner, J. and Jaye, F. *Draft of Inspector's Manual for Continuous Monitoring Systems (Acurex Corp./Aerotherm Div.).* Contract 68-01-3158. Task 8; (August 1976).
37. Air Pollution Training Institute. *Trainee's Manual, Field Enforcement in Air Pollution Control.* U.S. EPA; 1975. Unpublished.
38. Air Pollution Training Institute. *Instructor's Manual and Student Manual, APTI Course No 439, "Visible Emissions Evaluation,"* EPA-450/3-78-105 and EPA-450/3-78-106. Research Triangle Park, NC.
39. Kudlich, R., *Ringelmann Smoke Chart,* Bureau of Mines Information Circular No. 7718, No. 8333, revised. Dept of the Interior, May 1967.

B. SOURCES OF TECHNICAL INFORMATION AND FURTHER TRAINING OPPORTUNITIES

Sources of Technical Information

Many of the manuals should be available in the libraries of the individual agencies. However, where manuals would be helpful to the FEO, it is suggested he obtain a copy for his personal use.

Many publications can be obtained without cost by writing on agency letterhead to EPA Library Services.

A list of publications is shown in Appendix C.

Library Services

The Library Service Office at EPA, Research Triangle Park, North Carolina furnishes documents and literature searches for eligible groups and even personalized reference service.

For more information about library services, or to obtain single copies of EPA, A.P. documents write or call:

Library Services, MD-35
Environmental Protection Agency
Research Triangle Park, NC 27711

Commercial Phone 919-541-2777
FTS Phone 629-2777

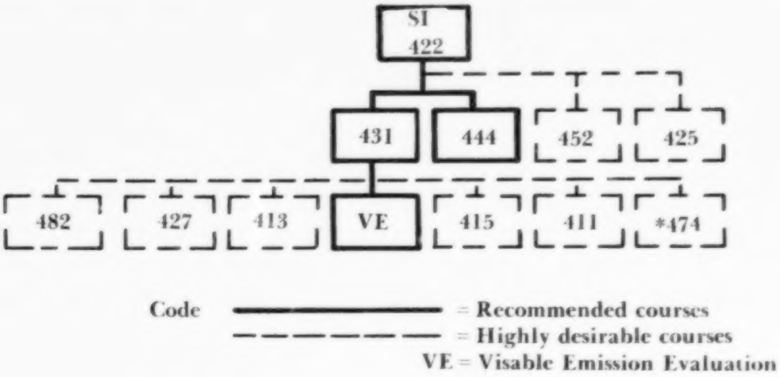
Training Courses

At the end of this course, it is evident that many of the FEO's activities were "introduced." The FEO should now consider the courses which are deeper in the individual areas which go to make up the whole job. For example, Course 425 goes deeper into legal aspects; 431 begins to probe control technology; 413, 415, 482 are quite technical in control equipment application; 450 is source sampling for particulates, and so on. See Figure B-1 for a recommended sequence of Courses for Field Inspection.

A catalog of available training courses is published annually by the APTI.

Information on training programs can be obtained by writing:

U.S. Environmental Protection Agency
Control Programs Development Division
Air Pollution Training Institute
MD 20
Research Triangle Park, NC 27711.



In addition to the courses shown above, the following courses are suggested for further job enrichment, based upon an individual's job and interests:

SI 406 435 SI 448 450 463 468 483

Figure B-1. Field Inspection Course Sequence
(For individuals who are involved in field inspection and enforcement in a governmental agency.)

Other Advanced Training

Those FEOs with bachelor's degrees should seriously consider advanced university training by entering master's degree programs either on a fulltime or parttime basis. Many universities arrange their classes in evenings and on weekends to accommodate those who are employed.

Look for scholarships or grants to fund advanced study. In 1979, the U.S. EPA has scholarships available and many agencies will pay tuition for such advanced study.

Attendance at national technical meetings and specialty conferences is an important source of up-to-date information on control technology.

Read periodicals and specialized reports. Have available a personal library containing literature related to your special problems. A list of selected publications of interest in enforcement, follows this section.

Never cease continuing education. Every phase of air quality control changes with time, so the FEO must read and study to keep up-to-date.

*Recommended for those who inspect continuous emission monitors.

C. LIST OF SELECTED PUBLICATIONS OF INTEREST IN ENFORCEMENT[1]

Background Information on Industrial Processes

EPA Reports:

1. *Air Pollution Engineering Manual, AP-40, second edition.* John Danielson, ed., US EPA, Research Triangle Park, NC; May 1973.
2. *Compilation of Air Pollution Factors, parts A and B with Supplement 1-5, AP-42.* US EPA-MDAD/OAQPS, Research Triangle Park, NC.
3. *Field Operations and Enforcement Manual for Air Pollution Control: Vol. I; Organization and Basic Procedures (APTD-1100), Vol. II; Control Technology and General Source Inspection (APTD-1101), Vol. III; Inspection Procedures for Specific Industries (APTD-1102). US EPA, Research Triangle Park, NC; August 1972.*
4. *Field Surveillance and Enforcement Guide for Primary Metallurgical Industries, EPA-450/3-73-002.* US EPA, Research Triangle Park, NC; December 1973.
5. *Controlled and Uncontrolled Emision Rates and Applicable Limitations for Eighty Processes.* EPA Contract 68-02-1382 Task Order #12, US EPA, Research Triangle Park, NC; September 1976.
6. *Technical Guide for Review and Evaluation of Compliance Schedules for Air Pollution Sources, EPA 340/1-73-001a.* US EPA—DSSE, Washington, DC; July 1973. (A revised and updated guide is being printed.)
7. *Industrial Process Profiles for Environmental Use: Chapter 3—Petroleum Refining Industry, EPA 600/2-77-023, Chapter 24—The Iron and Steel Industry, EPA 600/2-77-023x.* US EPA IERL/ORD, Research Triangle Park, NC; 1977. (Chapters 1-30 covering 30 industrial categories are being prepared.)
8. *Field Surveillance and Enforcement Guide: Wood Pulping Industry, 450/3-75-027.* US EPA, Research Triangle Park, NC; March 1975.
9. *Field Surveillance and Enforcement Guide: Petroleum Refineries, 450/3-75-042.* US EPA, Research Triangle Park, NC; July 1974.
10. *Background Information for Proposed New Source Performance Standards.* (Technical information reports describing the basic process equipment and operation are published for each source category for which Federal emission standards are promulgated) US EPA, ESED/OAQPS, Research Triangle Park, NC
11. *Inspection Manuals for Enforcement of New Source Performance Standards:*
    Fossil-Fuel-Fired Steam Generators, EPA 340/1-75-002;
    Portland Cement Plants, EPA 340/1-75-001;
    Municipal Incinerators, EPA 340/1-75-004;
    Asphalt Concrete Plants, EPA 340/1-76-003;
    Secondary Lead Smelters EPA 340/1-77-001;
    Basic Oxygen Process Furnaces, EPA 340/1-77-002;
    Secondary Brass & Bronze Ingot Production, EPA 340/1-77-003;
    Petroleum Refineries (being printed);
    Storage Vessels for Petroleum Liquids (being printed);
    Nitric Acid Plants (being prepared);
    Sulfuric Acid Plants (being prepared);
    Phosphate Fertilizer Plants (being prepared). US EPA DSSE, Washington, DC.

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[1] Source: Kirk & Foster, U.S. EPA, Division of Stationary Source Enforcement, 1978.

Text Books:

1. Stern, Arthur C., ed. *Air Pollution,* New York: Academic Press; 1977 (especially Vol. III).
2. Kirk and Othmer, ed. *Encyclopedia of Chemical Technology,* Interscience Publishers; 1970.
3. *McGraw-Hill Encyclopedia of Science and Technology,* McGraw-Hill; 1971.
4. Bond and Straub, ed. *Handbook of Environmental Control,* CRC Press; 1972 (especially Vol. I).
5. Lund, Herbert, ed. *Industrial Pollution Control Handbook,* McGraw-Hill; 1971.
6. Shreve, Norris. *Chemical Process Industries,* McGraw-Hill; 1967.

Miscellaneous Reports on Industrial Processes Displayed at Region IV Workshop:

1. *Source Assessment: Glass Container Manufacturing Plants, EPA-600/2-76-269.* US EPA, Research Triangle Park, NC; October 1976.
2. *Guidelines for Industrial Boiler Performance Improvement, EPA-600/8-77-003a.* US EPA, Research Triangle Park, NC; January 1977.

General Information on Enforcement Program Operation

1. *Field Operations and Enforcement Manual for Air Pollution Controls: Vol. I-Organization and Basic Procedures, APTD-1100.* US EPA, Research Triangle Park, NC; August 1972.
2. *Guidelines for Technical Services of a State Air Pollution Control Agency, APTD-1347.* US EPA, Research Triangle Park, NC; November 1972.
3. *Guide to Engineering Permit Processing, APTD-1164.* US EPA, Research Triangle Park, NC; July 1972.
4. *Enforcement Management System Users Guide, APTD-1237.* US EPA, Research Triangle Park, NC; September 1972.
5. *Analysis of Final State Implementation Plans—Rules and Regulations, APTD-1334.* US EPA, Research Triangle Park, NC; July 1972.

Sources of Current Industrial Process/Control and Stack Sampling Information

1. *U.S. EPA Cumulative Bibliography,* parts 1 and 2, PB 26S-920; December 1976.
2. *Computerized Literature Search Systems.* (There are several commercial computerized literature search systems. They are used through terminals located in many places. Employees of governmental air pollution control agencies, nonprofit citizens environmental groups and a few others can request searches using these services through the EPA library, MD-35, Research Triangle Park, NC 27711.

   Those seeking further information and other parties should contact the search service vendors listed below:

   Lockheed Retrieval System (Dialog)
   Dept. 208, Building 201
   3251 Hanover Street
   Palo Alto, California 94304
   (800) 277-1960

   System Development Corporation
   2500 Colorado Avenue
   Santa Monica, California 90406
   (800) 421-7229

   Bibliographic Research Service
   Corporation Park, Building 702
   Scotia, New York 12302
   (518) 374-5011

3. *Environmental Pollution & Control, (weekly government abstracts).* Weekly newsletter containing technical report summaries, $40/year, available from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Va. 22161.
4. *Stack Sampling News, (monthly),* publication for Source Testing Information, $30/yr., available from Technomic Publishing Co., 265 W. State St., Westport, Conn. 06880.
5. *Source Evaluation Society, Newsletter (quarterly),* $10/yr. Current Editor, Roger Shigerhara, ESED (MD-19), US EPA, Research Triangle Park, NC 27711.

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3. *Source Sampling Manual, January 1976.* Oregon Department of Environmental Quality, Air Quality Control Division, 1234 S.W. Morrison Street, Portland, OR, 97205.
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